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Distributed Mission Operations Within-Simulator Training Effectiveness Baseline Study: Participant Utility and Effectiveness Opinions and Ratings

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14. ABSTRACT
The work in this report focuses on the user acceptance of the Air Force Research Laboratory, Human Effectiveness Directorate, Warfighter Readiness Research Division (AFRL/HEA) Distributed Mission Operations (DMO) training research site which contains four high-fidelity F-16 simulators, an Airborne Warning and Control System (AWACS) simulator, a threat generation system, and a full complement of brief/debrief technologies. The 327 F-16 pilots and the 49 AWACS users based their opinions on experiences obtained during consistent local area network five-day training research syllabi containing over 40 total 4vX scenarios, primarily air-to-air with some air-to-ground. Examining the user ratings for opinions about the DMO environment revealed that across all 58 rated statements, both F-16 and AWACS participants generally like the environment. "I would recommend this training experience to other pilots/controllers" was rated by all but one of 49 controllers and all but 16 of 327 pilots with the highest rating possible of "Strongly Agree." Performing a content analysis on their open-ended responses to what they felt was most beneficial about the environment, F-16 pilots most frequently wrote comments relating to "realistic qualities," while AWACS operators most frequently wrote positive comments regarding the "scenarios." The second most written comment for both the F-16 and AWACS operators related to positive skill acquisition. Finally, when asked to rate to what extent the Mesa DMO system provides the 45 different F-16 critical air-to-air experiences (defined by the Mission Essential Competency process), the pilots rated that 38 experiences (84%) could be obtained "to a moderate extent" or higher, more than all seven other environments surveyed.

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EXECUTIVE SUMMARY

One of the first evaluation steps of a training system should be to establish user acceptance and determine how the operators visualize potential training utility. One of the more promising recent military training systems is Distributed Mission Operations (DMO) training. DMO training systems today typically consist of networked simulators to allow for multi-player training on realistic combat exercises. The work discussed in this report focuses on the user acceptance of the Air Force Research Laboratory, Human Effectiveness Directorate, Warfighter Training Research Division's (AFRL/HEA's) DMO training research site in Mesa, AZ. Specifically, how do the users perceive the value of the Mesa DMO system and what mission essential experiences is the Mesa DMO system perceived as providing valuable training? This work sought to document the F-16 and Airborne Warning and Control Station (AWACS) user opinion results in detail and provide the necessary summary results for the larger DMO training effectiveness study documented in AFRL-HE-AZ-TR-2006-0015, Volume I, Distributed Mission Operations Within-Simulator Training Effectiveness Baseline Study: Summary Report.

Users based their opinions on experiences obtained in the Mesa DMO training research environment. All 327 F-16 and 49 AWACS participants experienced a consistent local area network five-day training research syllabus containing over 40 total 4vX scenarios, primarily air-to-air with some air-to-ground. In conjunction with a computer-generated threat system and an instructor operator station, the Mesa DMO research environment consisted of four high-fidelity F-16 simulators, one high-fidelity AWACS simulator, and a full complement of high fidelity brief/debrief equipment (including time-stamped replays of avionic equipment and communication).

Examining the user ratings for opinions about the DMO environment revealed that across all 58 rated statements, both F-16 and AWACS participants generally like the environment. "I would recommend this training experience to other pilots/controllers" was rated by all but one of 49 controllers and all but 16 of 327 pilots with the highest rating possible of "Strongly Agree." Performing a content analysis on their open-ended responses to what they felt was most beneficial about the environment, F-16 pilots most frequently wrote comments relating to "realistic qualities," while AWACS operators most frequently wrote positive comments regarding the "scenarios." The second most written comment for both the F-16 and AWACS operators related to positive skill acquisition. Finally, when asked to rate to what extent the Mesa DMO system provides the 45 different F-16 critical air-to-air experiences (defined by the Mission Essential Competency process), the pilots rated the Mesa DMO higher than all seven other environments surveyed. Pilot rated that 38 experiences (84%) could be gained "to a moderate extent" or higher in the Mesa DMO environment, and 17 experiences (38%) were rated "to a substantial extent" or higher.

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INTRODUCTION

When evaluating a simulation training device, researchers may rely on a number of different data sources to assess training utility and overall effectiveness. One of the most common sources to rely on is participant opinion (i.e., user survey) data. Training research practitioners concur that user opinion does not bestow an adequate measure of training success or effectiveness, but it can establish user acceptance, which is often a necessary condition for continued system use, development, and/or further effectiveness research (Bell & Waag, 1998; Salas, Bowers, & Rhodenizer, 1998; Stanton, 1996). Therefore, one of the first evaluation steps of a training system should be to establish user acceptance and determine how the operators visualize potential training utility.

One of the more promising recent military training systems is Distributed Mission Operations (DMO) training. DMO training systems today typically consist of networked simulators to allow for multi-player training on realistic combat exercises. Significantly different than stand-alone simulation systems that train primarily emergency procedures or part-tasks, these networked simulation environments provide entire combat-like experiences involving the real-time interaction with other simulated entities, both friendly and foe. This allows for higher order skill development and teamwork coordination while executing significant portions of an entire mission. Before DMO, training opportunities for these larger scope experiences could rarely be gained outside of war. Some DMO environment examples within the United States Air Force (USAF) include Shaw Air Force Base (AFB), Eglin AFB, Mountain Home AFB, and the Air Force Research Laboratory's training research site in Mesa, AZ (AFRL/HEA). The current work focuses on the user acceptance of AFRL/HEA's DMO training research site which contains four high-fidelity F-16 simulators, an AWACS simulator, and a threat generation system. Naturally, we must then ask, "How do the users perceive the system as a training device?" And, "Which mission essential experiences do the users expect a system like Mesa's to provide?" Specifically regarding the Mesa DMO training research site, we now discuss each question and its relevant literature in turn.

How do the users perceive the Mesa DMO system?

A number of historical user acceptance results on very early multiplayer simulation environments might lead us to conclude that users would be generally positively disposed towards such training technologies (e.g., Thomas, Houck, & Bell, 1990; Houck, Thomas, & Bell, 1991; Waag & Houck, 1994). However, negative opinion study results are not usually published and the associated negatively-viewed training systems quietly fade into obscurity, hence the need to routinely perform user acceptance research on new or changing systems. Since DMO systems have been in existence a number of years and the contemporary versions have grown tremendously in popularity, the acceptance does seem somewhat assured; it almost goes without saying that observation among DMO participants, expert observers, and the DMO community in general appears to indicate overall DMO acceptance. We would expect the same of the Mesa Research Site. Recent DMO user opinion research, albeit only published work, validates this impression with warfighters and falls in-line with the older multiplayer simulation opinion results (Chapel, 2000; Crane, Robbins, & Bennett, 2000; Crane, Schiflett, & Oser, 2000). These three studies all examined the Mesa DMO training research site, and positive user opinions were given for the air combat DMO experiences, including specific positive feedback regarding training potential for skills such as communication, situation awareness, teamwork, tactical execution, leadership, briefing, beyond-visual-range tactics, decision making, and radar mechanization. We must remember, however, that each DMO system contains a unique set of interconnected technologies—the hardware, software, and physical/functional fidelity levels drastically differ depending on DMO location and, over time, these systems vary within each DMO location. The Mesa Research Site, unsurprisingly, has been upgraded over time. Inasmuch as the DMO systems vary, so too may user perceptions vary. DMO user opinion research should be conducted for each site and repeated when major physical or functional changes occur either in the DMO training environment or in the environment the DMO system is attempting to replicate.

Which mission essential experiences are provided?

With numerous simulations networked together, DMO affords very unique training. Unlike academics, part-task trainers, or stand-alone simulators, with DMO the training community can combine essential elements of battle into a single environment; that is, we can more closely replicate entire portions of battle without using actual assets. Warfighters therefore are provided the chance to bring together various skills and knowledge in combat-like missions, potentially providing them with the opportunity to obtain mission essential *experiences* once only gained during actual war or infrequent range exercises. Unfortunately, until recently, the research community did not possess a list of these mission essential warfighter experiences, and the prior user opinion research did not anchor to a common theoretical framework. As to be expected, user opinion research typically resulted from training research practitioners developing idiosyncratic surveys to evaluate each system, with a general theme revolving around perceived likes, dislikes, pros, cons, “sim-isms,” etc. Though these surveys do provide valuable information, ideally warfighters for given mission areas could be brought together and critical training experiences elicited from them in a deliberate and systematic manner; these warfighter-defined critical training experiences could then serve as the constructs on user training utility surveys, revealing the utility of the DMO system to provide/train each experience. Fortunately, the Mission Essential Competency (MEC) process (Colegrove & Alliger, 2002) is a systematic process that elicits this information from operational warfighters. Of particular relevance to the current work, the MEC process requires that operational warfighters define the critical experiences necessary for the warfighter to solidify knowledge and skills and therefore be fully prepared to perform his/her duties in a non-permissive environment. Table 1 is a list of the F-16 air-to-air combat critical experiences.

Table 1 The 45 F-16 air-to-air critical experiences defined by operational pilots as part of the MEC process.

Restrictions to visibility (e.g., haze)	Restricted weapons load (e.g., due to previous weapons employment, incompleted reload, or WRM limitations)
Visual illusions	Limited fuel remaining (e.g., due to increased fuel consumption, low fuel remaining, lack of tanker support, or the inability to inflight refuel)
Marginal/minimal cloud clearance	Operating area restrictions (e.g., geographic, altitude, or political)
Daytime employment	Degraded comm. (e.g., due to ownship systems malfunction, another aircraft's malfunction, or the inability to use HQ or secure voice by one or more aircraft)
Dusk employment	Formation responsibilities (e.g., position, visual lookout)
Night employment	Degraded weapons employment capability (e.g., fire control, RWR, missiles)
Dynamic retasking/scramble operations	Battle damage (e.g., operations with battle damage of ownship or of another aircraft in the formation)
G-induced physical limitations	Supersonic employment
Limited time to act/react to situation	A full range of adversary air threat and mix (e.g., various limitations in maneuvering, tactics, and weapons)
Operations with friendly IADS	A full range of adversary ground type and mix (including old and latest threats)
Task saturation	Various employment altitudes (e.g., low, med, high)
Degraded Nav	Ownship and friendly electronic counter measures
Radar search responsibilities	Operations against a threat using chaff/flare
Lost mutual support	Using chaff/flare to deny/defeat enemy radar/weapons.
Air refueling	Operations against adversary comm jam/spoofing
Emergency procedures	Operations against air or ground adversary jamming
Targeting and sorting responsibilities	ROE limitations (e.g., operations in an environment that has restrictive ID requirements (other than BVR weapons free) such as VID, PID, hostile declaration required by offboard sources)
Mountainous terrain	Fatigue/time on task (e.g., long range force employment)
1:1 Force ratio (e.g., 2 v 2, 4 v 4)	Various initial conditions (e.g., perch setups, CAP & tap, and flights on ranges)
1:2 Force ratio (e.g., 4 v 8)	Simulated weapons employment (e.g., training)
1:3+ Force ratio (e.g., 4 v 12+)	Live weapons employment (e.g., WSEP, combat)
OCA escort missions	Employment with various package requirements (e.g., operations in conjunction with different aircraft and supporting assets, includes determining and operating with minimum package requirements)
OCA sweep missions	

A DMO environment, as judged by warfighters, should provide many of these warfighter-defined experiences. For longer term research initiatives, the MEC critical experiences form a favored framework for formally mapping DMO user opinion research.

CURRENT WORK

For overall training effectiveness of the Mesa DMO training research site, (Schreiber & Bennett, 2006) reported a DMO training effectiveness study. In that report, the authors collected data on over 3,000 many versus many air combat engagements. The authors reported numerous different data sources converging on the highly positive in-simulator training effectiveness of the Mesa DMO research environment. As such, that report’s focus was to document the overall results from the central hypotheses of each dataset to establish within-simulator training effectiveness. In direct support of that overall study, two distinct user opinion data collection endeavors were analyzed for the current work. The first effort involved aggregating and analyzing a legacy

DMO user opinion survey collected from Mesa DMO warfighters during their week of participating in DMO training research. From continued use since January 2002, this survey produced a sizeable dataset for analysis. The second effort involved leveraging a portion of the MEC data collection process. Specifically, to what extent operational warfighters perceive that Mesa DMO can afford providing specific MEC experiences.

General goals for this work sought to (a) report the survey opinion results in detail, (b) leverage the new MEC process and document what MEC experiences the users feel DMO is best suited for, and (c) provide the summary results for the larger Schreiber and Bennett, (2006) DMO training effectiveness study. More specifically, we investigated the following hypotheses in support of the abovementioned goals:

1. Pilot participants will provide favorable ratings of the environment.
2. AWACS participants will provide favorable ratings of the environment.
3. Due to occasional, but significant enhancements to the Mesa DMO environment, we expect a significant corresponding increase in ratings over time.
4. We expect pilots to rate that the environment provides many of the essential experiences as defined by the MEC process.

METHODS

Mesa DMO Training Research Environment.

A portion of the following information is from General Method in Schreiber and Bennett (2006).

Users based their opinions on experiences obtained in the Mesa DMO training research environment. The Mesa DMO research environment operated predominantly as a stand-alone local area network (LAN), but about 15% of DMO exercises over the data collection period in the past several years were part of a larger, wide-area network (WAN) exercise. Of the users included in the current user opinion research work, all of them experienced a consistent LAN five-day training research syllabus containing over 40 total 4vX scenarios, primarily air-to-air with some air-to-ground. In conjunction with a computer generated threat system and an instructor operator station (IOS), the Mesa DMO research environment (Figure 1) consisted of four high-fidelity F-16 simulators and one high-fidelity Airborne Warning and Control System (AWACS) simulator. The F-16s, AWACS, and threat entities interoperated according to Distributed Interactive Simulation (DIS) standards (IEEE Standard for Distributed Interactive Simulation - Application Protocols, 1995) version 4.02 or version 6.0. Pictures of the overall environment, one F-16 simulator, the AWACS simulator, and the brief/debrief facility are provided in Figures 1-4, respectively.

Figure 1 Mesa DMO training research environment.

The high-fidelity F-16 Block 30 simulators utilized 360 degree out-the-window visual displays with either SGI Onyx II Reality Monsters or PC Nova IIs running Aechelon runtime software (Figure 2). The visual system used high resolution photo-realistic databases of the Sonoran desert overlaid on terrain elevation data of the region. The hardware was very nearly identical to that found in the actual F-16, as was the software (Software Capabilities Upgrade (SCU) version 4). Depending on the type of mission to be flown, F-16 weapon load-outs for missions usually consisted of differing combinations of the gun, the Air Intercept Missile (AIM-9), the Advanced Medium Range Air-to-Air Missile (AMRAAM), and/or the Mk-82 and Mk-84 general purpose bombs. A high-fidelity Solipsys version 6 AWACS sensor simulation was also used to provide a more realistic environment (Figure 3).

The Automated Threat Engagement System (ATES) generated the adversaries. ATES is a computerized, real-time threat generation system that operates on standard DIS networks, providing air-to-air, air-to-ground, and surface-to-air threats. The ATES system incorporates aerodynamic modeling, atmospheric models, radar models, infrared models, and data parameter tables for thrust, drag, lift, etc. For the current work, most threat air models were the MiG-29, MiG-27/23, and Su-27 loaded with the AA-8, AA-10a and AA-10c air-to-air missiles. Ground threats usually included the SA-2, SA-6, and SA-8, and AAA. Threat aircraft typically performed maneuvers and/or scripted flight paths while reacting to the F-16’s maneuvers and weapons.

Figure 2 Interior view of one of the four high-fidelity F-16 simulators.

Figure 3 Close-up view of the AWACS simulator.

The current debrief facility includes six 50-inch plasma screens -- one for a God's eye view, one for AWACS, and one dedicated for each of the four F-16s. Each of the F-16 plasma screens presented four avionic displays from the F-16 (Figure 4). The time synchronized replay included all communications and could be paused, fast-forwarded, or rewound according to the lead pilot's desired use of the allotted debrief time.

Figure 4 Brief/debrief room.

As a training research installation striving to continually integrate and evaluate new training technologies, personnel at the DMO site at Mesa enhanced the simulation systems. Therefore, the DMO simulation environment was *not* constant for all users. Some examples of upgrades/changes to the environment during the 33-month data collection period included (but are not limited to):

- Upgrading the visual databases in cockpits #3 and #4 to use the same photo-specific database used in cockpits #1 and #2,
- upgrading to eight visual channels,
- upgrading the radios,
- installing SCU-5 Situation Awareness DataLink (SADL) software,
- installing new ALQ-213 radar warning/electronic countermeasure panels and 5100 power PC boards,
- adding smoke trails to missile fly-outs,
- upgrading the brief/debrief facility with Portable Flight Planning Software version 3.2,
- and a sixth 50-inch plasma debrief display for AWACS.

Unfortunately, most of these upgrades were not dated, so partitioning the opinion datasets accordingly was not feasible. To examine if changes in user opinions did occur over time, we performed additional analyses by breaking up the 33-month data collection period into six time "slices."

DMO Reaction Survey (Appendix A):

The DMO Reaction survey consisted of two sections. The first section contained 58 "core" ratings with a 4-point scale (1 = Strongly Disagree; 2 = Somewhat Disagree; 3 = Somewhat Agree; and 4 = Strongly Agree), while the second section consisted of open-ended questions. The DMO Reaction survey was administered to participants towards the end of their DMO training research. For inclusion in the current work, we examined only those DMO Reaction surveys completed by participants in the overall within-simulator effectiveness study, a consistent five-day LAN-only DMO curriculum (Schreiber & Bennett, 2006). Of the 384 pilots in the overall study, 327 completed the DMO Reaction survey. An additional 49 AWACS controllers also completed the DMO Reaction survey. All but two of the 327 pilots were male, with an age range between 24 and 54 years (mean = 33.0). The pilots averaged 1,681 flight hours up to the time they participated in DMO at Mesa, and an average of 1,039 of the 1,681 total hours were F-16 hours. AWACS demographic information is available for 45 of the 49 participants. All but three of the 45 controllers were male, with an age range between 24 and 41 years (mean = 30.4) The DMO Reaction survey participants were not randomly sampled; they vied for posted training research opportunities at the Mesa Research Site. As such, these participants may, or even likely, be more positively disposed overall towards DMO than some of their peers and their ratings/opinions provided on the DMO Reaction form should be interpreted accordingly.

Due to the large number of statement ratings, we desired to categorize them for summary presentation. Retired F-16 SMEs completed a categorization task. During the initial phase, three SMEs independently sorted all statements into categories, with each SME producing between six and eight categories. From these 22 potential categories, two SMEs then collectively assigned each statement to a category, ultimately deciding that only seven categories were required to encompass all 58 statements. The resulting seven summary categories are shown in Table 2.

Table 2 DMO Reaction Survey Summary Categories

Category	Number of Statements
Home Unit Conditions	6
Overall Training Value	20
Syllabus/Mission Flow	8
DMO Opinions	11
General Comments About the DMO Environment	4
DMO Scenario Characteristics	3
DMO Expectations	6

From the second section of the survey—the open-ended questions—we did not choose to analyze many of the responses, as most open-ended questions were geared for internal developmental purposes to quickly identify and fix emerging problem areas. As such, we analyzed only the responses to the first open-ended question using a simple content analysis approach. Specifically, we examined the participants' responses to:

> *"List the top five things you feel were beneficial about the training you received here at DMO. Next to each item, please state why it was beneficial."*

The 318 pilots and 43 air weapons controllers provided one or more statements. In order to analyze these statements, segments (pieces of text) were created. Segments consisted of combining one "what they like" statement with the related "why" statement (e.g., "Realism of sims… Limited frustration with sim-isms"). There were 1,123 pilot segments and 187 AWACS segments. Three assistants then independently sorted and categorized the segments, with each person creating between 13 and 16 categories. After completing this first categorization sorting task, a researcher and a SME then used these initial categories to jointly finalize a single set of sixteen categories used for descriptive analysis.

MEC Experience Survey (Appendix B):

To identify the important training experiences, the final critical experiences from the MEC process were utilized. Since the majority of participants in the current work flew air-to-air oriented missions, we chose the 45 air superiority MEC experiences to implement in a survey to capture warfighter opinion on how well the Mesa DMO research system might provide each experience (i.e., assess perceived training utility). For comparative purposes, we asked each participant to rate the extent to which they felt each of the 45 experiences could be gained in eight different environments (360 total ratings), specifically:

1. Ready Aircrew Program (RAP) flying events--all except Flag and Composite Force Training (CFTR)
2. RAP (Flag and CFTR events)
3. MTC/FMT (Mission Training Center/Full Mission Trainer)
4. Operation Northern Watch (ONW), Operation Southern Watch (OSW)
5. UTD (Unit Training Device)
6. Mesa DMO
7. WTT/DTT (Weapons and Tactics Trainer/Desktop Trainer)
8. Sustained Combat Ops (e.g., Operation Allied Force (OAF), Desert Storm)

The MEC experience by environment survey was administered to 32 operational pilots who participated in five-day Mesa training research. All of the participants were male with an age range between 26 and 44 years (mean = 31.64). The pilots averaged 1,388 flight hours, of which 1,072 hours were F-16 hours. All 32 pilots completed the survey. As with the DMO Reaction Survey, the pilots who completed the MEC experience survey were not randomly sampled.

RESULTS

DMO Reaction Survey: Rated Statements

Before proceeding with the rated statement analysis, we needed to recode 10 of the 58 statements to maintain consistency across all rated items that a higher numbered score reflected a favorable DMO rating score (i.e., only for those recoded items, a “4” rating, for example, was recoded into “Strongly Disagree,” while for the non-recoded items a “4” rating remained “Strongly Agree”). In Tables 3-9, the recoded items are denoted with an asterisk (*). The rated statements were grouped and are reported here according to their summary categories from Table 2.

Prior to analyzing the overall aggregated dataset, we chose to partition the pilot reaction rating database into six time “slices” (about six months each) to investigate whether or not user opinions changed over time as a function of the aforementioned changes in the DMO environment. While there were insufficient AWACS operators to “time-slice” the database, six time slices provided sufficient pilot rating sample sizes for this investigation (between 43 and 64 pilots per time slice). Results from these analyses revealed a few statistically significant differences in user opinion summary category ratings over time. Only one of the seven summary categories—Scenario Characteristics--revealed a significant linear trend at an alpha criterion of .05, and it was in the expected upwards direction. Only the DMO Expectations category revealed a significant quadratic trend at the .05 level, but four of the seven categories revealed significant cubic trends. Despite some of these significant time results, we nonetheless chose to aggregate the database over time and report here the results for the entire time period for which data were collected. We chose this approach primarily because (a) though some results were *statistically significant*, we found the tight range in observed ratings over time to be *practically insignificant*, and (b) stable, consistent, and meaningful time-based trends from this tight results range are simply not apparent. Graphs and detailed results of the time-based analyses are provided in Appendix C.

For the entire 33-month data collection period, the results for the individual statements and summary scores for both pilots and AWACS participants are shown in Tables 3-9. For the 327 F-16 pilots across all individually rated statements, all 58 of the average rated scores were rather favorable; their average scores for a given statement ranged from a low of 2.56 (“As a result of this training, I have improved my VID tactics”) to a high of 3.94 for two statements (“I would recommend this training experience to other pilots/controllers” and “DMO will positively impact my combat mission readiness”), with only four of the 58 individual statements receiving an average rating below a three. Across the seven summary categories, all the summary category weighted means were found to be above 3.0 (3.20-3.72).

As with the pilot scores, for the 49 AWACS controllers across all individually rated statements, the average rated scores for the 58 statements were fairly high in general. Their average scores for a given statement ranged from a low of 2.45 (“This training provided excellent experience in radar mechanics”) to a very high, almost unanimous score of 3.98 (“I would recommend this training experience to other pilots/controllers”). Less than 20% (9/58) of all the individual statements received an average rating below a three. Across the seven summary categories, all the summary weighted means for AWACS participants were found to be above 3.0 (3.01-3.69).

Table 3 DMO Expectations Ratings.

DMO Reaction: *DMO Expectations*	**Pilots**	**AWACS**
Statement	**Mean (n; s.e.)**	**Mean (n; s.e.)**
I came to this training with low expectations*	3.54 (326; .04)	3.40 (47; .12)
I was prepared for the type of experience I observed / received in DMO	3.36 (327; .04)	3.51 (47; .11)
I expected more from this training than was delivered*	3.66 (327; .03)	3.51 (47; .13)
I expected this training to be a valuable experience	3.78 (327; .03)	3.72 (47; .08)
The goals I listed for this DMO exercise were met	3.68 (321; .03)	3.64 (47; .09)
The expectations I listed for this DMO exercise were met	3.75 (321; .03)	3.77 (44; .06)
DMO Expectations Overall Score (N=1949)	**3.63 (1949; .03)**	**3.59 (279; .10)**

Table 4 DMO Opinions Ratings.

DMO Reaction: *DMO Opinions*	**Pilots**	**AWACS**
Statement	**Mean (n; s.e.)**	**Mean (n; s.e.)**
This training experience has motivated me to seek similar training opportunities	3.85 (327; .02)	3.83 (47; .06)
The DMO learning objectives were presented clearly	3.50 (327; .04)	3.26 (47; .11)
I would recommend this training experience to other pilots / controllers	3.94 (326; .02)	3.98 (48; .02)
DMO offers an excellent opportunity to view multiple complex presentations	3.88 (327; .03)	3.81 (48; .08)
DMO provides realistic training and experience	3.54 (327; .03)	3.22 (48; .11)
DMO has limited military training value*	3.76 (327; .04)	3.56 (48; .13)
Using DMO in conjunction with live flying is worthwhile	3.81 (325; .03)	3.92 (48; .04)
I would like to see DMO operational applications expanded	3.81 (327; .02)	3.96 (49; .03)
DMO provides valuable experience in combat mission tactics	3.89 (327; .02)	3.90 (49; .04)
DMO should be a part of all future spin-up exercises	3.70 (325; .03)	3.77 (47; .08)
The DMO missions I experienced were unrealistic*	3.27 (326; .05)	3.35 (48; .11)
Overall DMO Opinions	**3.72 (3591; .03)**	**3.69 (527; .07)**

Table 5 DMO Scenario Characteristics.

DMO Reaction: *DMO Scenario Characteristics*	**Pilots**	**AWACS**
Statement	**Mean (n; s.e.)**	**Mean (n; s.e.)**
The scenarios were well designed	3.67 (327; .03)	3.63 (49; .08)
The threats in DMO behaved as they do in the operational environment	3.0 (325; .04)	3.09 (46; .11)
Rate the degree to which you feel the Intel briefing was useful for missions flown	3.03 (301; .04)	2.98 (42; .10)
Overall DMO Scenario Characteristics	**3.23 (953; .04)**	**3.23 (137; .10)**

Table 6 General Comments about the DMO Environment.

DMO Reaction: *General Comments about the DMO Environment*	**Pilots**	**AWACS**
Statement	**Mean (n; s.e.)**	**Mean (n; s.e.)**
The visual scenes in DMO were realistic	3.17 (327; .04)	2.86 (42; .14)
DMO missions and engagements accurately represent how things happen in the operational world	2.91 (327; .04)	3.0 (48; .11)
The visual databases were realistic	3.23 (323; .04)	2.91 (44; .12)
The fidelity of the DMO environment was sufficient to achieve the desired mission/training objectives	3.50 (327; .04)	3.28 (47; .13)
Overall General Comments About the DMO Environment	**3.20 (1304; .04)**	**3.01 (181; .12)**

Table 7 Home Unit Conditions.

DMO Reaction: *Home Unit Conditions*	**Pilots**	**AWACS**
Statement	**Mean (n; s.e.)**	**Mean (n; s.e.)**
I will have an opportunity to use what I've learned at my operational unit	3.80 (327; .03)	3.83 (47; .06)
Daily operational unit requirements are conducive to my maintaining the skills I have learned in DMO	2.94 (324; .06)	3.09 (46; .14)
I can routinely get the type of experience I had in DMO at my home unit*	3.79 (327; .03)	3.35 (48; .13)
At my unit, I routinely get to fly against realistic threats*	3.29 (327; .05)	2.74 (43; .15)
There are a sufficient number of 4vX flying opportunities at my unit*	3.29 (327; .04)	2.98 (47; .13)
I routinely get to practice tactics in multiple aircraft environments at my operational unit*	3.28 (327; .05)	2.68 (44; .15)
Overall Home Unit Conditions	**3.40 (1959; .04)**	**3.01 (275; .13)**

Table 8 Overall Training Value.

DMO Reaction: *Overall Training Value*	**Pilots**	**AWACS**
Statement	**Mean (n; s.e.)**	**Mean (n; s.e.)**
DMO will positively impact my combat mission readiness	3.94 (326; .01)	3.85 (48; .06)
Participating in the DMO program was a good use of my time	3.93 (327; .02)	3.96 (47; .03)
The material I learned in DMO is useful for my future flying / AWACS experience	3.88 (326; .02)	3.91 (47; .07)
The missions helped me to effectively meet my learning objectives	3.80 (326; .03)	3.75 (48; .08)
This training provided excellent experience in radar mechanics	3.83 (327; .03)	2.45 (40; .16)

Table 9 Overall Training Value. (Cont'd)

DMO Reaction: Overall Training Value Statement	Pilots Mean (n; s.e.)	AWACS Mean (n; s.e.)
As a result of this training, I have improved my mission planning skills	3.23 (327; .04)	3.26 (46; .13)
I have improved my tactical skills as a result of the DMO experience	3.89 (327; .02)	3.92 (48; .04)
DMO has considerable combat mission training value	3.90 (327; .02)	3.83 (48; .07)
I am confident that I can perform the tasks taught in this training program in the field	3.68 (327; .03)	3.67 (48; .09)
DMO improved my understanding of critical combat skills	3.68 (326; .03)	3.76 (49; .06)
I improved my briefing and debriefing skills	3.31 (319; .04)	2.76 (45; .13)
DMO has improved my combat mission readiness	3.85 (326; .02)	3.82 (49; .06)
This training provided excellent practice on 3-1 communication	3.92 (326; .02)	3.94 (49; .03)
As a result of this training, I have improved my BVR tactics	3.93 (327; .01)	3.64 (39; .11)
I feel I will be better prepared for to brief and lead a mission due to this training	3.80 (324; .03)	3.38 (42; .13)
I am confident I will perform better as a fighter pilot / controller as a result of DMO	3.88 (327; .02)	3.83 (48; .07)
As a result of this training, I have improved my VID tactics	2.56 (327; .05)	2.71 (28; .18)
DMO has helped me improve my team coordination skills	3.62 (327; .03)	3.60 (48; .08)
This training helped me improve my combat situational awareness	3.79 (327; .03)	3.82 (49; .06)
The skills I trained in DMO are the same as those I am expected to perform in the field	3.39 (325; .04)	3.65 (49; .09)
Overall Training	**3.69 (6521; .03)**	**3.58 (915; .09)**

Table 10 Syllabus Mission Flow.

DMO Reaction: ***Syllabus Mission Flow*** **Statement**	**Pilots** **Mean (n; s.e.)**	**AWACS** **Mean (n; s.e.)**
The missions were sequenced in a way that facilitated my learning	3.68 (327; .03)	3.75 (48; .07)
I felt the training was appropriately paced	3.73 (327; .03)	3.85 (47; .06)
The missions were challenging	3.86 (327; .02)	3.64 (47; .09)
It was difficult to keep up with the pace of the missions*	2.93 (326; .05)	3.30 (47; .10)
The missions were not very realistic*	3.21 (326; .05)	3.0 (47; .12)
In training, I was able to apply lessons learned from previous missions to new ones	3.76 (327; .03)	3.83 (47; .06)
The syllabus and missions were presented in an organized manner	3.59 (326; .03)	3.51 (47; .09)
The missions and engagements were very challenging	3.79 (326; .03)	3.38 (48; .10)
Overall Syllabus Mission Flow	**3.57 (2612; .03)**	**3.53 (378; .09)**

DMO Reaction Survey: Open-Ended Responses

Before calculating item frequencies, we checked the reliability of the coded segments using 80% agreement as our criterion (Lombard, Snyder-Duch, & Bracken, 2005; Neuendorf, 2002). This agreement percentage was calculated using the total number of identical coded statements (ICS) divided by NSC, or the total number of segments categorized (i.e., ICS/NCS). The coding for the pilots' data achieved a 91.6% agreement and the data from the AWACS achieved an 80.7% agreement. The number of statements per category is provided for both the pilots and the AWACS participants in Table 10 and the percentages of total responses are graphed in Figure 5. Results varied by pilots and AWACS participants. With a combined total of over half their comments, pilots most liked the realistic qualities or the skill improvement/acquisition. AWACS operators, on the other hand, responded with a combined total of over 40% of their comments that they most liked the scenarios and the skill improvement gained from the briefs/debriefs.

Table 11 Number of comments by category.

Category	**% of comments (pilots)**	**% of comments (AWACS)**	**Frequency (pilots)**	**Frequency (AWACS)**
Realistic Qualities	28.14%	1.07%	316	2
Skill Improvement/Acquisition	24.49%	2.14%	275	4
Briefs/Debriefs (Training specific facilities)	10.95%	8.02%	123	15
Communication	7.30%	8.56%	82	16
Tactics	6.77%	7.49%	76	14
Scenarios (Quantity/Variety/Quality)	3.83%	22.99%	43	43
Controller/AWACS Integration	3.21%	8.02%	36	15
SIM Characteristics	3.21%	7.49%	36	14
Situation Awareness	3.03%	6.99%	34	13
Cold Ops	2.32%	2.67%	26	5
Threats	2.23%	2.14%	25	4
Incidentals (non-DMO references)	1.96%	1.60%	22	3
Other Training Related Benefits	.98%	1.60%	11	3
Weapons/Weapon Employment	.80%	0%	9	0
Briefs/Debriefs (Skill Improvement Acquisition)	.53%	18.72%	6	35
Briefs/Debriefs (Non-Specific)	16%	.53%	3	1

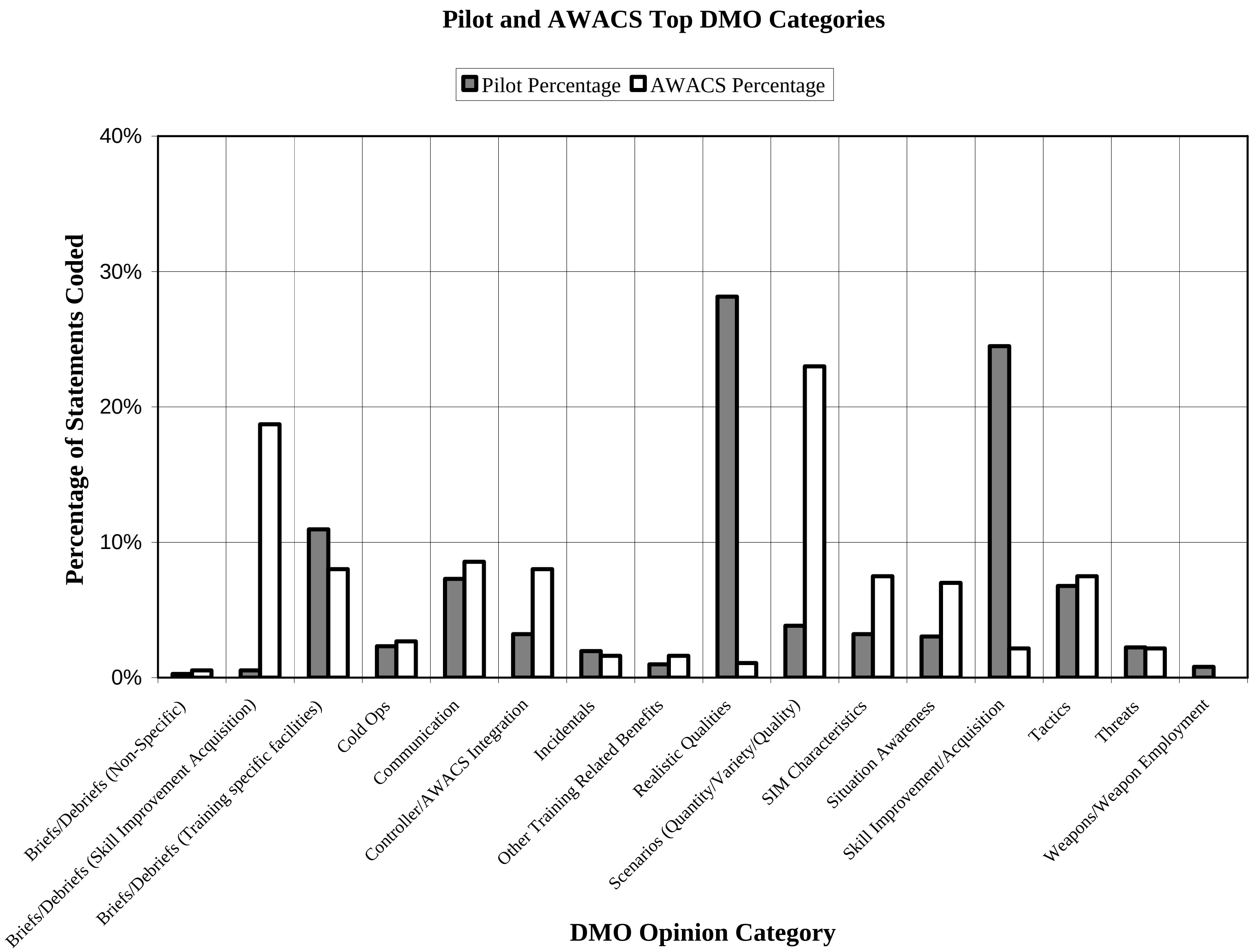

Figure 5 Percentage of overall responses by category.

As a final examination of the DMO Reaction Survey, and only because there is typically fair interest, we report here ten notable quotations provided by the participants. We remind the reader that these are selected quotations from the users; these quotations are not reported in any scientific manner and should not be construed as representative of all the direct quotations provided.

1. We were able to get training we can't get at home without typical distractions.
2. The excellent simulations combined with outstanding debriefing tools plus the amount of "sorties" in such a short time led to increased skills in all areas
3. Equipment…Love the Hi tech debrief tools (training rules)
4. Execution…Most efficient I have ever seen
5. Facilities…Top notch visual / realistic trainer cockpit
6. Only place to receive this quantity and level of training

7. Realism…Train how we fight
8. Multiple bandits with realistic contact ranges is invaluable
9. Ground control intercept (GCI) and fighter interaction. . . I have never had this level of understanding of the importance of communication pacing and how critical it is to use the correct verbiage
10. Quality of Debriefs…Getting a 100% accurate picture with all cockpit data is an important part of learning from the debrief

MEC DMO Experiences Survey:

The pilots rated each of the 45 MEC experiences on a 5-point scale as to the extent that different environments provide training for that experience. For reference, the scale used was:

0 = Not at all/Does Not Apply
1 = To a Slight Extent
2 = To a Moderate Extent
3 = To a Substantial Extent
4 = To a Great Extent

Across all 45 MEC experiences, the average ratings per environment were computed and a within-subjects analysis of variance (ANOVA) performed. The differences in average ratings between environments was found to be highly significant, $F(7,217) = 11.96$, $p < .01$, with the Mesa DMO environment rated highest overall and the WTT/DTT environment rated lowest overall. Contrasts tests comparing the Mesa DMO environment average against the average of all other environments revealed that Mesa was rated significantly higher (at alpha = .01) than all but one pairwise comparison (the only exception being the RAP Flag/CFTR environment category). Therefore, it was not surprising to find that the distribution of ratings varied with environment, as shown in Table 11. Ratings for the WTT/DTT and ONW/OSW environments were generally negative, while ratings for Mesa DMO were most positive. Only three of the eight environments (Mesa DMO and the two RAP environment categories) were judged to provide half or more of the MEC experiences “to a moderate extent” or better.

Individual cell rating results show drastically different averages for each of the eight environments across the 45 various experiences (i.e., the 360 cells), ranging from the lowest rating of just .25 (tied) for two environments (MTC/FMT and WTT/DTT) providing the “G-induced physical limitations” experience, to a high of 3.66 for the Mesa DMO environment providing the “1:3+ Force Ratio” experience. For each of the 45 MEC experiences, the highest and lowest rated environment was identified and tabulated; the results are shown in Table 12. The Mesa DMO environment was rated as best (or tied as best) for providing 29/45 (64.4%) of the MEC experiences, while the WTT/DTT environment category was rated worst (or tied for worst) for 33/45 (73.3%) of the MEC experiences. The complete average rating results per cell (i.e., each experience by each environment) are provided as referenced in Appendix D.

Table 12 Ratings averaged over all 45 MEC experiences.

Environment	Avg rating over all 45 experiences	% of experiences rated 3 or higher	% of experiences rated 2 or higher	% of experiences rated 1 or higher
Mesa DMO	2.65	40%	84.4%	95.6%
RAP Flag/CFTR	2.37	4.4%	75.6%	100%
RAP except Flag/CFTR	2.09	4.4%	60%	97.8%
UTD	1.85	0	44.4%	93.3%
Sustained Combat Ops	1.74	2.2%	33.3%	91.1%
MTC/FMT	1.54	0	11.1%	86.7%
ONW/OSW	1.08	0	0	60%
WTT/DTT	0.93	0	0	40%

Table 13 Number and percentage of experiences rated highest or lowest for each environment.

Environment	# Experiences rated highest (or tied for highest)	%	# Experiences rated lowest (or tied for lowest)	%
All RAP except Flag/CFTR	3	6.7%	0	0
RAP Flag/CFTR	9	20%	0	0
MTC/FMT	0	0	3	6.7%
ONW/OSW	0	0	14	31.1%
UTD	2	4.4%	0	0
Mesa DMO	29	64.4%	0	0
WTT/DTT	0	0	33	73.3%
Sustained Combat Ops	4	8.9%	0	0

DISCUSSION

Upon reviewing the results, overall validity of the user responses seems intact, thereby allowing us to draw some meaningful conclusions. If the participants were not taking adequate time to complete the DMO Reaction survey or were not taking the survey seriously, we would expect conflicting ratings for similarly rated statement elements. Some elements within the DMO

Reaction survey were specifically worded similarly for this evaluation, and neither pilots nor AWACS participants provided conflicting ratings (e.g., ratings for “I expected this training to be a valuable experience” were high AND ratings for “I expected more from this training than was delivered” were low [before recoding]). As another example, from the experience by environments survey certain key cells showed distinctly different (and expected) results (e.g., low ratings for “G-induced physical limitations” should be observed in a fixed-base simulation environment). Furthermore, the training syllabi were geared more towards pilots, so higher overall pilot DMO Reaction survey ratings compared to AWACS was to be expected. Given the valid responses, we now discuss the results from each analysis in turn.

Overall, the DMO Reaction rating data shows acceptance of the Mesa research environment, as clearly evidenced by the fact that scores for all participants, both pilots and AWACS controllers, were relatively high for all seven summary categories. Of all the rated elements on the reaction form, statements recommending the experience to peers arguably may be the most indicative of user opinion regarding the environment. The single most highly rated statement (of all 58 rated statements) for both pilots and AWACS controllers was the same, was very nearly unanimous, and was of the peer recommendation nature: “I would recommend this training experience to other pilots/controllers” was rated by all but one of 49 controllers and all but 16 of 327 pilots with the highest rating possible of “Strongly Agree.”

Over the course of the data collection period, continuous improvements were made to the DMO environment, but we found only small (and few significant) changes in DMO Reaction ratings over time. We expected a more noticeable rise in average observed DMO Reaction ratings. Outside of a likely cause for raters tending to anchor, one other possible explanation for the relatively flat result is that, as pilots have become more familiar and comfortable with DMO systems over the past few years, the expectations may have also raised. Expectation increases could easily be negating or “canceling out” corresponding increases in user perceptions, thereby yielding roughly the same ratings over time.

We must preface our discussion of the DMO Reaction content analysis results by stating that the question analyzed was leading, asking only for the perceived “likes” of the environment. As such, those statements infrequently reported should certainly not be interpreted as “dislikes” about the environment. Additionally, an opinionated and verbose participant would provide up to five statements, while some other participants may have provided only one (or even none). Therefore, participants and their statements are disproportionately represented in the data. With that being said, we believe that the content analysis still does reveal some interesting patterns. As could be expected with different backgrounds and vocations, the pilots and AWACS personnel provided statements that generally differed in what they best liked about the environment. However, one common perception shared by both demographics was the skill acquisition. But, the manner in which they reported it differed; the AWACS operators reported the skill acquisition primarily as a function of brief/debrief, while the pilots reported it in more of a general context (with some trepidation, we infer that a fair portion of the skill acquisition is therefore due to the simulator “flying”). These self-generated user statements regarding skill acquisition are extremely well buttressed by our other research documenting the extent of in-simulator DMO learning at the Mesa Research Site (Schreiber & Bennett, 2006; Schreiber, Stock, & Bennett, 2006; Schreiber, Gehr, & Bennett, 2006).

The experience ratings revealed that the pilots clearly believe the Mesa DMO environment affords substantial training utility in providing the various MEC experiences, as evidenced by:

- Mesa DMO had the highest overall average rating across all experiences,
- the Mesa DMO environment was rated as best providing 29/45 of the experiences, and
- Mesa DMO was rated as able to provide 84.4% of all the experiences “to a moderate extent” or better

—all three statistics were higher for Mesa DMO than all seven other environments.

Though the average overall ratings were highest for the Mesa DMO environment, care should still be taken when comparing overall ratings among environments, especially Mesa versus the other environments. First, and probably of least impact on the results, these results assume each experience is equal—an unlikely assumption. If the experiences were weighted by importance, we might have observed slightly different results. Second, as discussed in the methods section, pilots were not randomly selected and may be more positively disposed towards DMO (though if this were a strong effect, we would have expected somewhat higher results for the MTC/FMT environment). And lastly, most expenses for participation at Mesa were covered by Mesa, possibly influencing ratings. Though some of these caveats may diminish the interpretive strength of the Mesa DMO MEC experience ratings, we believe it does so only “to a slight extent” (especially since we believe fighter pilots tend to give their honest opinions on anonymous surveys). On the other hand, higher ratings for many of the MEC experiences were expected of the Mesa DMO site due to the nature of the training research performed there. The scenarios and syllabi used at Mesa during this study were carefully designed to train specific air-to-air MEC skills, so it logically follows that ratings of the environment could trend higher as a result. How much each of these factors influenced ratings is unknown, but putting these scientific philosophical interpretive moderators aside, we believe it is still clear that the warfighters certainly do not view the Mesa DMO training utility as negative, and they likely perceive it as one of the more utilitarian environments in which to gain the MEC experiences.

Interestingly, some of the perceived experience ratings were likely low because pilots did not attempt to extrapolate beyond what was personally experienced. Or, many pilots used the “Does Not Apply” rating of zero because they were unaware that a capability existed. For example, the experience “air refueling” was rated quite low in both the Mesa DMO and the MTC/FMT environments. Air refueling was never experienced during the course of any of the Mesa DMO training research weeks, yet the Mesa DMO environment could easily be configured to provide that type of experience and the F-16 MTC (at Shaw AFB) can currently provide air refueling scenarios (but air refuelings are rarely done in the MTC environment).

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ACRONYMS

AA	Air-to-Air
AAA	Antiaircraft Artillery
AFB	Air Force Base
AFRL	Air Force Research Laboratory
AFRL/HEA	AFRL designation for Mesa Research Site
AIM	Air Intercept Missile
AMRAAM	Advanced Medium Range Air-to-Air Missile
ANOVA	Analysis of Variance
ATES	Automated Threat Engagement System
AWACS	Airborne Warning and Control System
CFTR	Composite Force Training
DIS	Distributed Interactive Simulation
DMO	Distributed Mission Operations
DTT	Desktop Trainer
IEEE	Institute of Electrical and Electronics Engineers
FMT	Full Mission Trainer
GCI	Ground Control Intercept
IOS	Instructor Operator Station
LAN	Local Area Network
MEC	Mission Essential Competencies
MiG	Initials of **Mi**koyan-**G**urevich Design Bureau
Mk	Mark
MTC	Mission Training Center
OCA	Offensive Counter Air
ONW/OSW	Operations Northern Watch/ Operations Southern Watch
RAP	Ready Aircrew Program
SADL	Situation Awareness DataLink
SCU	Software Capabilities Upgrade
SME	Subject Matter Expert
USAF	United States Air Force
UTD	Unit Training Device
VID	Virtual Image Display
WAN	Wide Area Network
WTT/DTT	Weapon and Tactics Trainer/Desk Top Trainer

APPENDIX A
DMO Reaction Survey

REACTIONS TO DMO/DMT AND SIMULATION-BASED TRAINING EXPERIENCE

I UNDERSTAND THAT MY PARTICIPATION IN THIS RESEARCH EFFORT IS *VOLUNTARY* AND THAT MY COMPLETION OF THIS INSTRUMENT AND/OR MY PROVIDING DATA TO AFRL/HEA RESEARCHERS CONSTITUTES MY CONSENT TO PARTICIPATE IN THE RESEARCH EFFORT.

Instructions:

The next few pages contain statements to assess how you feel about the concept of Distributed Mission Training (DMT) as demonstrated in the training syllabus you have participated in this week. Although you may have experienced, seen or heard about other similar programs in the field or proposed, we are specifically interested in your AFRL/HEA experience. Please read each statement carefully and decide which of the response choices is most true about your reactions to AFRL/HEA DMT and to the training program. Please make your responses by circling the number that indicates how strongly you agree or disagree with each statement. A rating of “4” means you *strongly agree* with the statement and a rating of “1” means you *strongly disagree* with the statement.

On the last page are a few short answer questions that will help us improve specific training-related areas for the future.

Date:__________ Unit:__________ 5 Digit ID Number:______________

Syllabus: (circle one)

MQT

FLUG

IPUG

WIC

ADV. AIR-to-AIRAA-1 CT AA-2A CT

AA-2G CT

	Strongly Disagree	Somewhat Disagree	Somewhat Agree	Strongly Agree
I will have an opportunity to use what I've learned at my operational unit.	1	2	3	4
DMO will positively impact my combat mission readiness.	1	2	3	4
This training experience has motivated me to seek similar training opportunities.	1	2	3	4
Daily operational unit requirements are conducive to my maintaining the skills I have learned in DMO.	1	2	3	4
Participating in the DMO program was a good use of my time.	1	2	3	4
The DMO learning objectives were presented clearly.	1	2	3	4
The missions were sequenced in a way that facilitated my learning.	1	2	3	4
The visual scenes in DMO were realistic.	1	2	3	4
The material I learned in DMO is useful for my future flying / AWACS experience.	1	2	3	4
The missions helped me to effectively meet my learning objectives.	1	2	3	4
I came to this training with low expectations.	1	2	3	4
I would recommend this training experience to other pilots / controllers.	1	2	3	4
I felt the training was appropriately paced.	1	2	3	4
I was prepared for the type of experience I observed / received in DMO.	1	2	3	4
The missions were challenging.	1	2	3	4
It was difficult to keep up with the pace of the missions.	1	2	3	4
The missions were not very realistic.	1	2	3	4
DMO offers an excellent opportunity to view multiple complex presentations.	1	2	3	4
I can routinely get the type of experience I had in DMO at my home unit.	1	2	3	4
In training, I was able to apply lessons learned from previous missions to new ones.	1	2	3	4
DMO provides realistic training and experience.	1	2	3	4
This training provided excellent experience in radar mechanics.	1	2	3	4
I expected more from this training than was delivered.	1	2	3	4
The syllabus and missions were presented in an organized manner.	1	2	3	4
As a result of this training, I have improved my mission planning skills.	1	2	3	4
At my unit, I routinely get to fly against realistic threats.	1	2	3	4
I have improved my tactical skills as a result of the DMO experience.	1	2	3	4

	Strongly Disagree	Somewhat Disagree	Somewhat Agree	Strongly Agree
DMO has considerable combat mission training value.	1	2	3	4
I am confident that I can perform the tasks taught in this training program in the field.	1	2	3	4
There are a sufficient number of 4Vx flying opportunities at my unit.	1	2	3	4
DMO improved my understanding of critical combat skills.	1	2	3	4
The scenarios were well designed.	1	2	3	4
DMO missions and engagements accurately represent how things happen in the operational world.	1	2	3	4
I improved my briefing and debriefing skills.	1	2	3	4
The visual databases were realistic.	1	2	3	4
The fidelity of the DMO environment was sufficient to achieve the desired mission/training objectives.	1	2	3	4
DMO has limited military training value.	1	2	3	4
Using DMO in conjunction with live flying is worthwhile.	1	2	3	4
DMO has improved my combat mission readiness.	1	2	3	4
I would like to see DMO operational applications expanded.	1	2	3	4
This training provided excellent practice on 3-1 communication.	1	2	3	4
DMO provides valuable experience in combat mission tactics.	1	2	3	4
I expected this training to be a valuable experience.	1	2	3	4
As a result of this training, I have improved my BVR tactics.	1	2	3	4
DMO should be a part of all future spin-up exercises.	1	2	3	4
I feel I will be better prepared for to brief and lead a mission due to this training.	1	2	3	4
I am confident I will perform better as a fighter pilot / controller as a result of DMO.	1	2	3	4
I routinely get to practice tactics in multiple aircraft environments at my operational unit.	1	2	3	4
As a result of this training, I have improved my VID tactics.	1	2	3	4
The threats in DMO behaved as they do in the operational environment	1	2	3	4
DMO has helped me improve my team coordination skills.	1	2	3	4
The missions and engagements were very challenging.	1	2	3	4
The DMO missions I experienced were unrealistic.	1	2	3	4
This training helped me improve my combat situational awareness.	1	2	3	4

	Strongly Disagree	Somewhat Disagree	Somewhat Agree	Strongly Agree
The skills I trained in DMO are the same as those I am expected to perform in the field.	1	2	3	4
Rate the degree to which you feel the Intel briefing was useful for missions flown.	1	2	3	4
The goals I listed for this DMO exercise were met.	1	2	3	4
The expectations I listed for this DMO exercise were met.	1	2	3	4
Instructor Pilots Only				
As an IP, I am motivated to seek similar training opportunities for my trainees.	1	2	3	4
The DMO syllabus helps prepare pilots for future combat mission readiness.	1	2	3	4
DMO offers an excellent means to practice brief and debrief protocol.	1	2	3	4
Using DMO to enhance mission essential competencies is worthwhile.	1	2	3	4
AWACS Only				
The AWACS console was realistic.	1	2	3	4
WIC Spin-up Participants Only				
The DMO syllabus we used helped me prepare for WIC.	1	2	3	4
DMO offers an excellent means to practice ACT.	1	2	3	4
Using the Nellis range for the training was beneficial to my preparations for WIC.	1	2	3	4
Using DMO as part of WIC spin-up is worthwhile.	1	2	3	4
DMO should be a part of all future WIC spin-up activities.	1	2	3	4
I feel I will be better prepared for WIC due to this training.	1	2	3	4

On this last page, please comment, as appropriate, to each of the following questions.

1. List the "top five" things you feel were beneficial about the training you received here at DMT. Next to each item, please state why it was beneficial

   a. ___________________ Why? ______________________________________

   b. ___________________ Why? ______________________________________

   c. ___________________ Why? ______________________________________

   d. ___________________ Why? ______________________________________

   e. ___________________ Why? ______________________________________

2. The WIC spin-up represents our first attempt to provide a sequenced, learning objectives-based syllabus for DMT. Do you feel this is an appropriate way to structure complex training such as this? (If applicable)

   Circle one: Definitely Yes Probably Definitely Not

3. What recommendations do you have that would improve the Intel portion of your in-brief?

4. What recommendations do you have that could improve the training process next time?

5. Were there any aspects of your AFRL/HEA DMT experience that you felt led to unrealistic or inappropriate content being provided? If so, please provide details below.

6. If you could improve one technical capability of the simulation training environment at AFRL/HEA what would it be? And why?

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APPENDIX B:
MEC Experience Survey

Air-to-Air MEC^{SM} Ranking and Rating Questionnaire

MEC Definitions

1. **Plan/Prepare for Mission:** Reviews, understands, and identifies limitations of intelligence and all mission-related documents (e.g., ATO, ACO, SPINS); reviews available assets for communications/data management during mission and synergistic combat effects of other assets; conducts route and target area risk, and own ship/flight asset analyses; formulates game plan to include maps, comms, ingress and egress, timing, mission materials, DTC/DTM/MC load; conducts contingency planning, including strengths/weaknesses of game plan; identifies possible problems such as fallout or timing problems and appropriate reactions; effectively briefs game plan with all available assets including any joint or coalition assets; assembles all necessary materials to bring on mission.

   Start: At mission tasking (ATO publication)
   End: End of mission brief
   Purpose: Equip and organize the package

2. **Force Organization MEC:** Organizes forces to enable combat employment

   Starting Point: Force organization begins when the force enters the area of interest and initial check-in with Command and Control.
   Purpose: Establish communication links with all assets; establish force structure (e.g,. position, timing, and relationship to package); determine any known force limitations.
   End Point: At the establishment of the CAP or at the push.

3. **Detection Phase MEC:** Detects factor groups in the area of responsibility.

   Starting Point: Detection starts when the flight enters the vulnerability period or push time and is in a position to target a designated airborne entity and start an intercept. From an ISR perspective detection is a continuous process. Follow-on waves or groups of potential targets must be detected in area of responsibility (AOR) to maintain SA and provide triggers for subsequent decisions.
   Purpose: Process information necessary to trigger the commit decision on entities that meet commit criteria.
   End Point: Normally when the flight lead makes the commit decision. Detection is actually a continuous process for the entire vulnerability period.

4. **Intercept and Targeting Phase MEC: Intercepts and targets factor groups.**

   Starting Point: Intercept and targeting starts at the commit. Geometry and contact ranges may cause the two parts of this phase to blend together. Very short commits may not have an intercept portion and flights may have to go directly to targeting. As with detection, targeting may be a repetitive action if multiple entities and waves are involved.
   Purpose: Arrive with a positional advantage and in a position to employ ordnance. Deconflict shots.
   End Point: When engagement criteria are met in terms of weapons parameters, ROE, and target identification.

5. **Engagement Phase MEC:** Employs ordnance against valid hostile targets and/or denies enemy weapons IAW mission objectives.

   Starting Point: Engagement starts at weapons employment/defensive reaction. Encompasses ROE, weapons employment and all aspects of offensive and defensive maneuvering.

Purpose: Defeat/deny enemy forces (offensively and defensively)
End Point: Engagement ends when the fighter/flight has achieved the engagement objectives, has to disengage due to fuel/ordnance considerations, or has successfully negated an enemy attack.

6. **Assessment/Reconstitution Phase MEC: Determines and initiates appropriate follow on actions (e.g., the need/ability to engage follow-on forces, return to the CAP, go to the tanker, RTB.)**

   Starting Point: Assessment starts when the fighter/flight has negated the initial threat through denial or defeat. Assumes a defensive situation has been resolved.
   Purpose: Identifies the need to re-engage the initial threat, engage subsequent threats, and the ability to continue to defend the airspace. Information from this phase used to decide whether to initiate follow-on intercept/targeting, return to detection, air refuel, or return to base.
   End Point: This phase ends with the initiation of a follow-on action.

7. **Force Orientation MEC: Remains oriented to force requirements.**

   Starting Point: Force orientation begins when organization has been accomplished, initiation of the gameplan and reacting with and in response to each other in an inter-team arrangement.
   Purpose: Individual, flight and force management and orientation during execution of prescribed mission.
   End Point: Package elements have egressed, conducted post-strike activities such as refueling, and no longer function in an inter-team arrangement.

8. **Phase Transition MEC**: Recognizes the trigger events/situations that require a shift from one phase to the next.

   Starting Point: Recognizing trigger events/situations that require a shift from one phase to the next begins when the flight enters the vulnerability period or push time and is in a position to start an intercept or target a designated airborne entity.
   Purpose: Gathered information is used to make decisions (e.g., commit, engage, and follow-on decisions)
   End Point: At the completion of the mission.

Air-to-Air MEC Ranking and Rating Questionnaire

Instructions: Complete this survey by ranking the left-hand column and rating the right-hand column according to the directions for each column.

In this column, using numbers 1 to 8, **rank** each of the eight **MEC**s in terms of your preparedness for performing each **MEC** in sustained combat operations. Use “1” for the **MEC** for which you have the highest level of preparedness, “2” for the **MEC** for which you have the next highest level of preparedness, and so forth, through number “8”. **Use each number, 1 through 8 only once.**

Note: you may feel prepared to perform

each **MEC**, but please rank them 1 to 8

In this column, using the scale below, **rate** each **MEC**:

1 = I am not ready to perform this area in a non-permissive environment.

2 = I’m ready to go, however I’d like to get a substantial amount of additional experience in this area.

3 = I’m ready to go, however I’d like to get a fair amount of additional experience in this area.

4 = I’m ready to go, however I’d like to get a little additional experience in this area.

5 = I’m ready to go, and I need no additional experience in this area.

RANK	Mission Essential Competency (MEC)	RATING
	Plan/Prepare for Mission	
	Force Organization	
	Detection Phase	
	Intercept and Targeting Phase	
	Engagement Phase	
	Assessment/Reconstitution Phase	
	Force Orientation	
	Phase Transition	

Research Id #:________________________

Date:________________

Air-to-Air MEC^{SM} Experiences and Environments (Ratings) Questionnaire

Definitions of Air-to-Air Current or Recent Learning Environments

1. **RAP Flying Events:** All Ready Aircrew Program flying events, with the exception of Flag/CFTR
2. **RAP Flying Events:** Flag/CFTRs
   - Flag – Red, Green, or Maple Flag participation
   - CFTR – Scenarios employing multiple flights of the same or different types of aircraft, each under the direction of its own flight leader, performing the same or different roles
3. **MTC/FMT –** All simulator missions in the Mission Training Center and Full Mission Trainer
4. **ONW/OSW** – All experiences in Operations Northern or Southern Watch
5. **UTD –** Training conducted in this high-fidelity squadron level Unit Training Device
6. **AFRL/Mesa –** Training conducted at the Air Force Research Lab in Mesa. This is a highly integrated set of four F16 simulators
7. **WTT/DTT –** Training conducted in the Weapons and Tactics Trainer and Desk Top Trainer
8. **Sustained Combat Operations –** Missions flown during declared hostilities such as OAF and Desert Storm. Does not include ONW or OSW

Air-to-Air MEC[SM] Experience and Environments (Ratings)

Instructions:

The matrix below lists learning environments across the top. Please refer to the previous page for a more complete description of each environment.

Common experiences (operations under various conditions) are listed down the left-hand side.

We are trying to identify whether experiences can realistically be trained in various environments. Please rate to what extent it is <u>reasonably possible to provide</u> each experience in each environment.

0 = Not at all/Does Not Apply
1 = To a Slight Extent
2 = To a Moderate Extent
3 = To a Substantial Extent
4 = To a Great Extent

To what extent can operations… ……under these conditions / be experienced in these environments?	**Environments**							
	RAP Flying Events		**MTC/ FMT**	**ONW/ OSW**	**UTD**	**AFRL/ Mesa**	**WTT/DTT**	**Sustained Combat Ops (e.g., OAF, Desert Storm)**
	All except Flag/CFTR	**Flag/CFTR**						
1. Restricted weapons load (e.g., due to previous weapons employment, incompleted reload, or WRM limitations)								
2. Limited fuel remaining (e.g., due to increased fuel consumption, low fuel remaining, lack of tanker support, or the inability to inflight refuel)								
3. Operating area restrictions (e.g., geographic, altitude, or political)								
4. Restrictions to visibility (e.g., haze)								
5. Visual illusions								
6. Marginal/minimal cloud clearance								

We are trying to identify whether experiences can realistically be trained in various environments. Please rate to what extent it is <u>reasonably possible to provide</u> each experience in each environment.

0 = Not at all/Does Not Apply
1 = To a Slight Extent
2 = To a Moderate Extent
3 = To a Substantial Extent
4 = To a Great Extent

To what extent can operations… ……under these conditions / be experienced in these environments?	**Environments**							
	RAP Flying Events		**MTC/ FMT**	**ONW/ OSW**	**UTD**	**AFRL/ Mesa**	**WTT/DTT**	**Sustained Combat Ops (e.g., OAF, Desert Storm)**
	All except Flag/CFTR	**Flag/CFTR**						
7. Daytime employment								
8. Dusk employment								
9. Night employment								
10. Mountainous terrain								
11. G-induced physical limitations								
12. Degraded comm.. (e.g., due to ownship systems malfunction, another aircraft's malfunction, or the inability to use HQ or secure voice by one or more aircraft)								
13. Degraded nav.								
14. Degraded weapons employment capability (e.g., fire control, RWR, missiles)								
15. Battle damage (e.g., operations with battle damage of ownship or of another aircraft in the formation)								
16. Supersonic employment								

We are trying to identify whether experiences can realistically be trained in various environments. Please rate to what extent it is <u>reasonably possible to provide</u> each experience in each environment.

0 = Not at all/Does Not Apply
1 = To a Slight Extent
2 = To a Moderate Extent
3 = To a Substantial Extent
4 = To a Great Extent

To what extent can operations… ……under these conditions / be experienced in these environments?	**Environments**							
	RAP Flying Events		**MTC/ FMT**	**ONW/ OSW**	**UTD**	**AFRL/ Mesa**	**WTT/DTT**	**Sustained Combat Ops (e.g., OAF, Desert Storm)**
	All except Flag/CFTR	**Flag/CFTR**						
17. A full range of adversary air threat and mix (e.g., various limitations in maneuvering, tactics, and weapons)								
18. A full range of adversary ground type and mix (including old and latest threats)								
19. Operations with friendly IADS								
20. Ownship and friendly electronic counter measures								
21. Operations against a threat using chaff/flare								
22. Using chaff/flare to deny/defeat enemy radar/weapons.								
23. Operations against adversary comm. jam/spoofing								
24. Operations against air or ground adversary jamming								

We are trying to identify whether experiences can realistically be trained in various environments. Please rate to what extent it is <u>reasonably possible to provide</u> each experience in each environment.

0 = Not at all/Does Not Apply
1 = To a Slight Extent
2 = To a Moderate Extent
3 = To a Substantial Extent
4 = To a Great Extent

To what extent can operations…	**Environments**							
……under these conditions / be experienced in these environments?	**RAP Flying Events**		**MTC/ FMT**	**ONW/ OSW**	**UTD**	**AFRL/ Mesa**	**WTT/DTT**	**Sustained Combat Ops (e.g., OAF, Desert Storm)**
	All except Flag/CFTR	**Flag/CFTR**						
25. ROE limitations (e.g., operations in an environment that has restrictive ID requirements (other than BVR weapons free) such as VID, PID, hostile declaration required by offboard sources)								
26. Fatigue/time on task (e.g., long range force employment)								
27. Task saturation								
28. Limited time to act/react to situation								
29. Radar search responsibilities								
30. Targeting and sorting responsibilities								
31. Air refueling								
32. Live weapons employment (e.g., WSEP, combat)								
33. Simulated weapons employment (e.g., training)								

We are trying to identify whether experiences can realistically be trained in various environments. Please rate to what extent it is <u>reasonably possible to provide</u> each experience in each environment.

0 = Not at all/Does Not Apply
1 = To a Slight Extent
2 = To a Moderate Extent
3 = To a Substantial Extent
4 = To a Great Extent

To what extent can operations… ……under these conditions / be experienced in these environments?	**Environments** — **RAP Flying Events**: **All except Flag/CFTR**	**Flag/CFTR**	**MTC/ FMT**	**ONW/ OSW**	**UTD**	**AFRL/ Mesa**	**WTT/DTT**	**Sustained Combat Ops (e.g., OAF, Desert Storm)**
34. Various initial conditions (e.g., perch setups, CAP & tap, and flights on ranges)								
35. Emergency procedures								
36. Formation responsibilities (e.g., position, visual lookout)								
37. Lost mutual support								
38. Dynamic retasking/scramble operations								
39. Various employment altitudes (e.g., low, med, high)								
40. 1:1 Force ratio (e.g., 2 v 2, 4 v 4)								
41. 1:2 Force ratio (e.g., 4 v 8)								
42. 1:3+ Force ratio (e.g., 4 v 12+)								
43. OCA escort missions								
44. OCA sweep missions								

We are trying to identify whether experiences can realistically be trained in various environments. Please rate to what extent it is <u>reasonably possible to provide</u> each experience in each environment.

0 = Not at all/Does Not Apply
1 = To a Slight Extent
2 = To a Moderate Extent
3 = To a Substantial Extent
4 = To a Great Extent

To what extent can operations… ……under these conditions / be experienced in these environments?	**Environments**							
	RAP Flying Events		**MTC/ FMT**	**ONW/ OSW**	**UTD**	**AFRL/ Mesa**	**WTT/DTT**	**Sustained Combat Ops (e.g., OAF, Desert Storm)**
	All except Flag/CFTR	**Flag/CFTR**						
45. Employment with various package requirements (e.g., operations in conjunction with different aircraft and supporting assets, includes determining and operating with minimum package requirements)								

APPENDIX C:
Time-Based Analysis of DMO Reaction Results

Table 14 Number of Participants per Group Over Time

Participant Groups Over Time	Number of Participants
January 2002-June 2002	43
July 2002-December 2002	52
January 2003-June 2003	56
July 2003-December 2003	64
January 2004-June 2004	64
July 2002-October 2004	47

Table 2 Overall Effect of Time on DMO Expectations

Source	Type III Sum of Squares	Degrees of Freedom	Mean Square	F	Sig.
Corrected Model	2.469[a]	5	.494	3.676	.003
Intercept	4201.996	1	4201.996	31277.871	.000
Participant Groups Over Time	2.469	5	.494	3.676	.003
Error	42.990	320	.134		
Total	4327.249	326			
Corrected Total	45.459	325			

a: R Squared = .054 (Adjusted R Squared = .040)

Table 3 DMO Expectations Contrast Results

Participant Group	Polynomial Contrast		DMO Expectations
Linear	Contrast Estimate		.000
	Hypothesized Value		0
	Difference (Estimate- Hypothesized)		.000
	Standard Error		.053
	Significance		.996
	95% Confidence Interval	Lower Bound	-.104
	for Difference	Upper Bound	.104
Quadratic	Contrast Estimate		.017
	Hypothesized Value		0
	Difference (Estimate- Hypothesized)		.017
	Standard Error		.052
	Significance		.739
	95% Confidence Interval	Lower Bound	-.085
	for Difference	Upper Bound	.119
Cubic	Contrast Estimate		.155
	Hypothesized Value		0
	Difference (Estimate- Hypothesized)		.155
	Standard Error		.050
	Significance		.002
	95% Confidence Interval	Lower Bound	.056
	for Difference	Upper Bound	.253

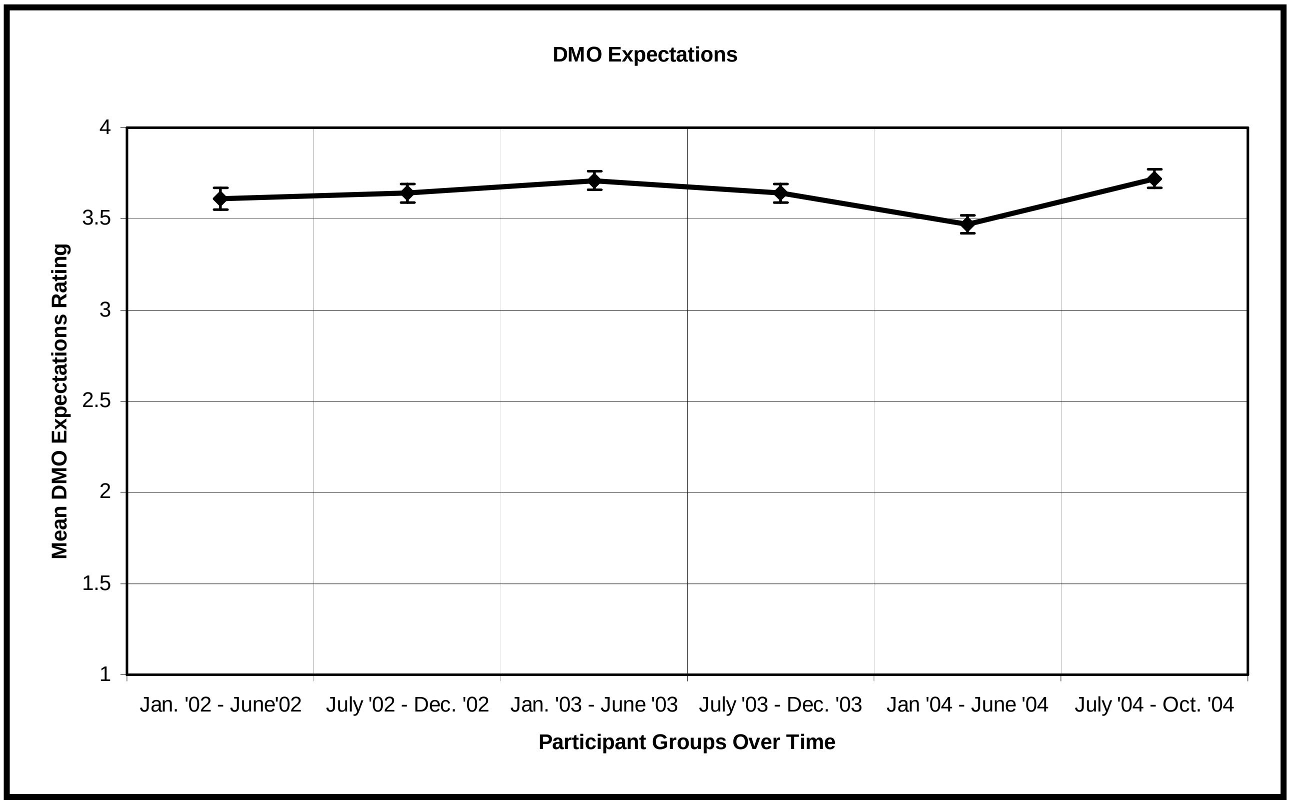

Figure 1 Overall Effect of Time on DMO Expectations

Table 4_Overall Effect of Time on DMO Opinions

Source	Type III Sum of Squares	Degrees of Freedom	Mean Square	F	Sig.
Corrected Model	.490[a]	5	.098	1.361	.239
Intercept	4419.41	1	4419.413	61321.615	.000
Participant Groups Over Time	.490	5	.098	1.361	.239
Error	23.062	320	.072		
Total	4540.541	326			
Corrected Total	23.552	325			

a: R Squared = .021 (Adjusted R Squared = .006)

Table 5 DMO Opinions Contrast Results

Participant Group Polynomial Contrast			DMO Expectations
Linear	Contrast Estimate		.062
	Hypothesized Value		0
	Difference (Estimate- Hypothesized)		.062
	Standard Error		.039
	Significance		.112
	95% Confidence Interval	Lower Bound	-.015
	for Difference	Upper Bound	.138
Quadratic	Contrast Estimate		-.009
	Hypothesized Value		0
	Difference (Estimate- Hypothesized)		-.009
	Standard Error		.038
	Significance		.814
	95% Confidence Interval	Lower Bound	-.084
	for Difference	Upper Bound	.066
Cubic	Contrast Estimate		.069
	Hypothesized Value		0
	Difference (Estimate- Hypothesized)		.069
	Standard Error		.037
	Significance		.060
	95% Confidence Interval	Lower Bound	-.003
	for Difference	Upper Bound	.141

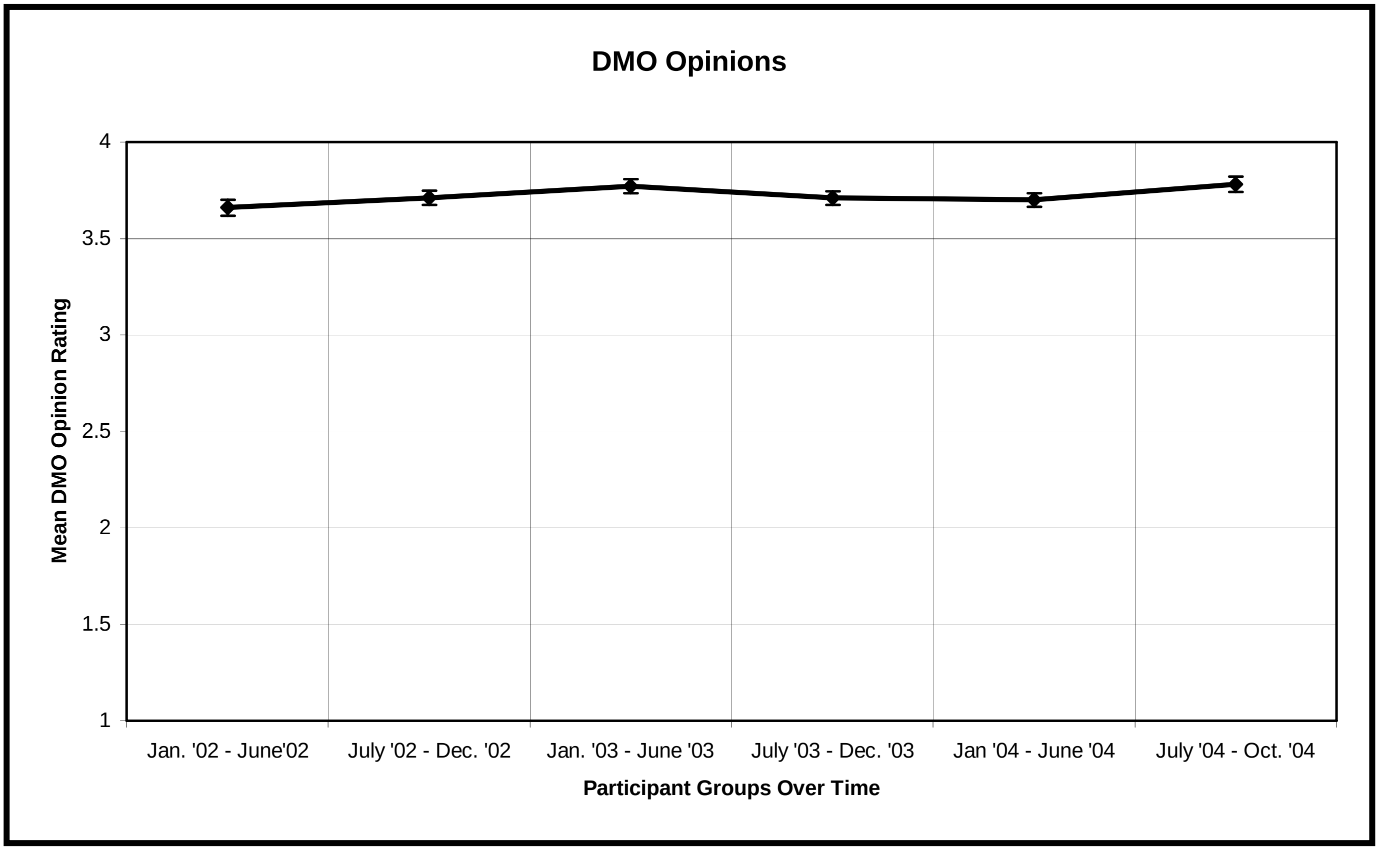

Figure 2 Overall Effect of Time on DMO Opinions

Table 6 Overall Effect of Time on DMO Scenario Characteristics

Source	Type III Sum of Squares	Degrees of Freedom	Mean Square	F	Sig.
Corrected Model	1.847[a]	5	.369	1.694	.136
Intercept	3185.901	1	3185.901	14613.972	.000
Participant Groups Over Time	1.847	5	.369	1.694	.136
Error	69.761	320	.218		
Total	3334.333	326			
Corrected Total	71.608	325			

a: R Squared = .026 (Adjusted R Squared = .011)

Table 7 DMO Scenario Characteristics Contrast Results

Participant Group	Polynomial Contrast		DMO Expectations
Linear	Contrast Estimate		.139
	Hypothesized Value		0
	Difference (Estimate- Hypothesized)		.139
	Standard Error		.067
	Significance		.041
	95% Confidence Interval	Lower Bound	.006
	for Difference	Upper Bound	.271
Quadratic	Contrast Estimate		-.055
	Hypothesized Value		0
	Difference (Estimate- Hypothesized)		-.055
	Standard Error		.066
	Significance		.405
	95% Confidence Interval	Lower Bound	-.185
	for Difference	Upper Bound	.075
Cubic	Contrast Estimate		.086
	Hypothesized Value		0
	Difference (Estimate- Hypothesized)		.086
	Standard Error		.064
	Significance		.177
	95% Confidence Interval	Lower Bound	-.039
	for Difference	Upper Bound	.212

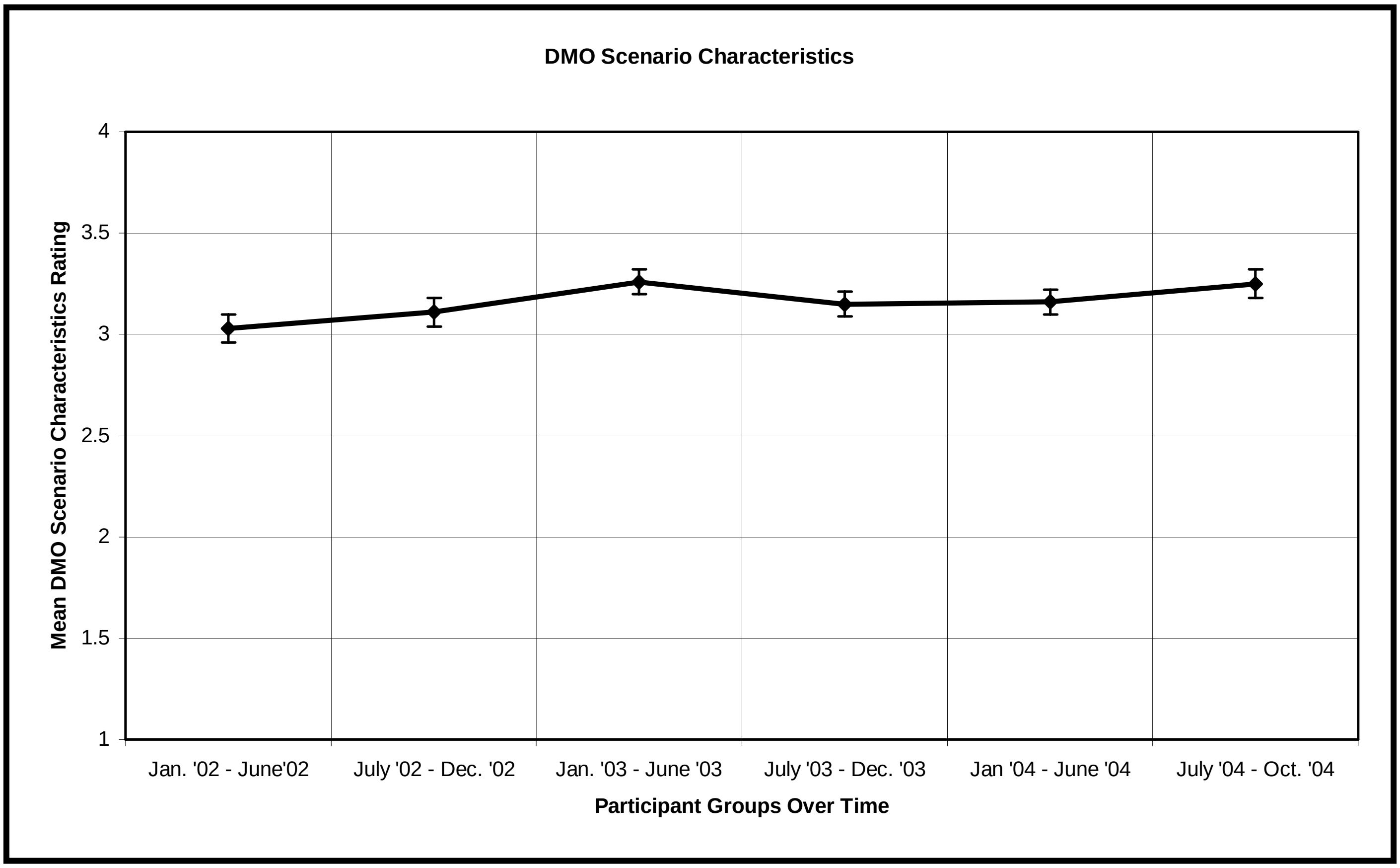

Figure 3 Overall Effect of Time on DMO Scenario Characteristics

Table 8 Overall Effect of Time on General Comments About the DMO Environment

Source	Type III Sum of Squares	Degrees of Freedom	Mean Square	F	Sig.
Corrected Model	3.366[a]	5	.673	1.517	.184
Intercept	3300.567	1	3300.567	7439.529	.000
Participant Groups Over Time	3.366	5	.673	1.517	.184
Error	141.969	320	.444		
Total	3541.208	326			
Corrected Total	145.335	325			

a: R Squared = .023 (Adjusted R Squared = .008)

Table 9 General Comments about the DMO Environment Contrast Results

Participant Group Polynomial Contrast			DMO Expectations
Linear	Contrast Estimate		.062
	Hypothesized Value		0
	Difference (Estimate- Hypothesized)		.062
	Standard Error		.096
	Significance		.523
	95% Confidence Interval	Lower Bound	-.128
	for Difference	Upper Bound	.251
Quadratic	Contrast Estimate		-.196
	Hypothesized Value		0
	Difference (Estimate- Hypothesized)		-.196
	Standard Error		.094
	Significance		.039
	95% Confidence Interval	Lower Bound	-.381
	for Difference	Upper Bound	-.01
Cubic	Contrast Estimate		.020
	Hypothesized Value		0
	Difference (Estimate- Hypothesized)		.020
	Standard Error		.091
	Significance		.829
	95% Confidence Interval	Lower Bound	-.159
	for Difference	Upper Bound	.199

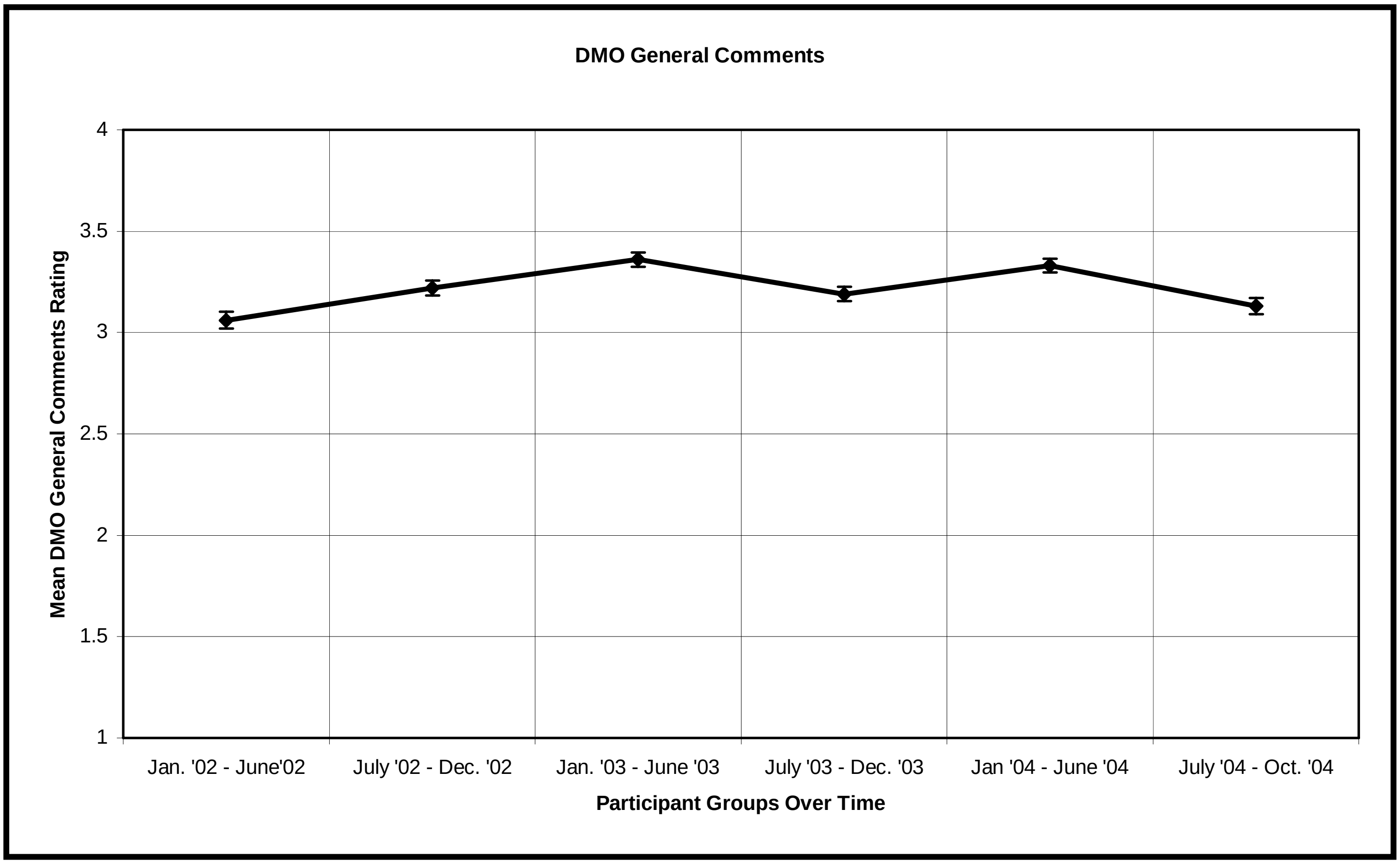

Figure 4 Overall Effect of Time on General Comments about the DMO Environment

Table 10 Overall Effect of Time on Home Unit Conditions

Source	Type III Sum of Squares	Degrees of Freedom	Mean Square	F	Sig.
Corrected Model	2.479[a]	5	.496	1.746	.124
Intercept	3754.029	1	3754.029	13215.916	.000
Participant Groups Over Time	2.479	5	.496	1.746	.124
Error	90.897	320	.284		
Total	3936.879	326			
Corrected Total	93.377	325			

a: R Squared = .023 (Adjusted R Squared = .008)

Table 11 Home Unit Conditions Contrast Results

Participant Group Polynomial Contrast			DMO Expectations
Linear	Contrast Estimate		.123
	Hypothesized Value		0
	Difference (Estimate- Hypothesized)		.123
	Standard Error		.077
	Significance		.110
	95% Confidence Interval for Difference	Lower Bound	-.028
		Upper Bound	.275
Quadratic	Contrast Estimate		-.081
	Hypothesized Value		0
	Difference (Estimate- Hypothesized)		-.081
	Standard Error		.075
	Significance		.283
	95% Confidence Interval for Difference	Lower Bound	-.230
		Upper Bound	.067
Cubic	Contrast Estimate		.142
	Hypothesized Value		0
	Difference (Estimate- Hypothesized)		.142
	Standard Error		.073
	Significance		.051
	95% Confidence Interval for Difference	Lower Bound	-.001
		Upper Bound	.286

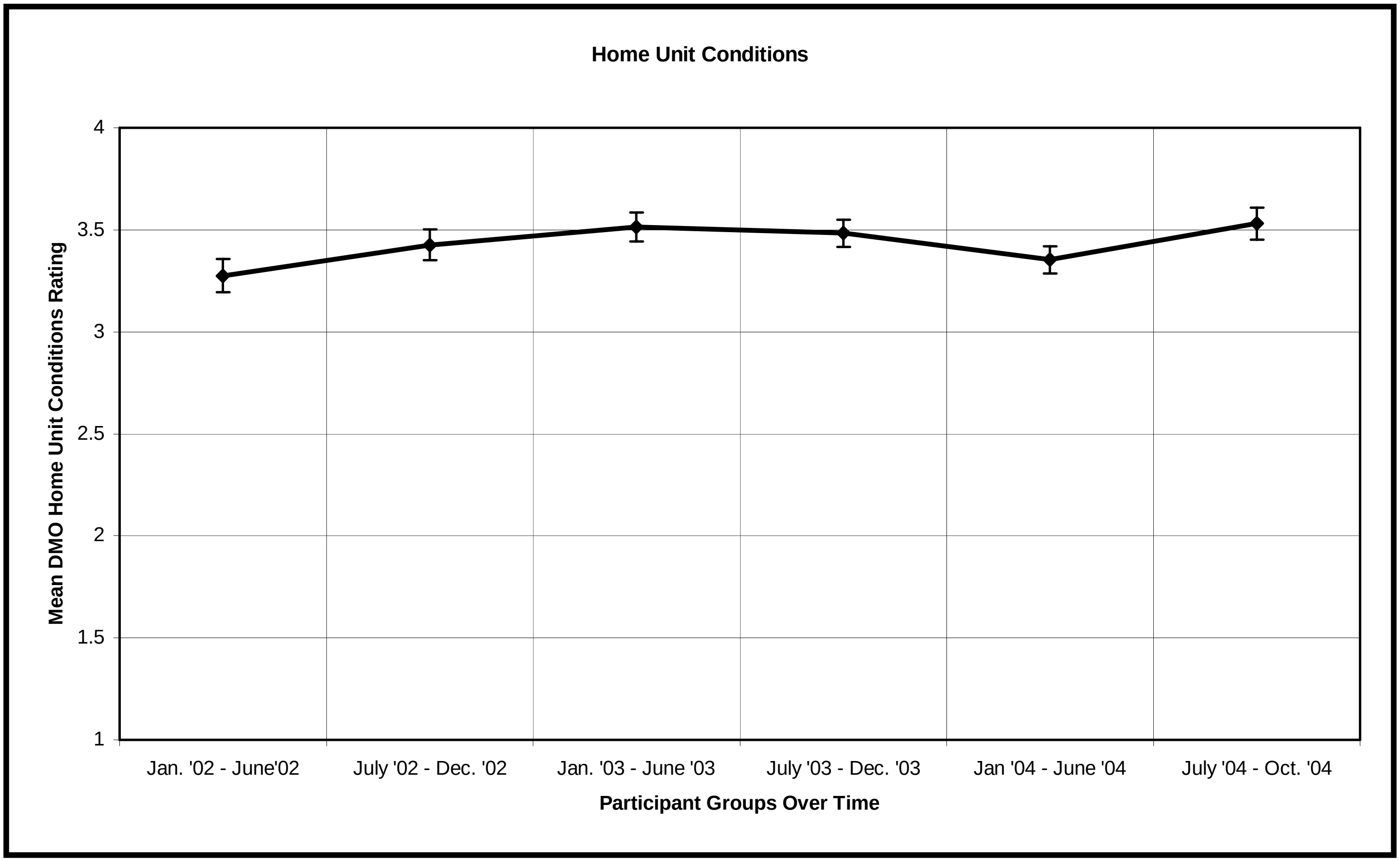

Figure 5 Overall Effect of Time on Home Unit Conditions

Table 12 Overall Effect of Time on DMO Overall Training Value

Source	Type III Sum of Squares	Degrees of Freedom	Mean Square	F	Sig.
Corrected Model	.533[a]	5	.107	1.560	.171
Intercept	4348.941	1	4348.941	63706.126	.000
Participant Groups Over Time	.533	5	.107	1.560	.171
Error	21.845	320	.068		
Total	4462.975	326			
Corrected Total	22.378	325			

a: R Squared = .024 (Adjusted R Squared = .009)

Table 13 DMO Overall Training Value Contrast Results

Participant Group Polynomial Contrast			DMO Expectations
Linear	Contrast Estimate		-.004
	Hypothesized Value		0
	Difference (Estimate- Hypothesized)		-.004
	Standard Error		.038
	Significance		.920
	95% Confidence Interval	Lower Bound	-.078
	for Difference	Upper Bound	.070
Quadratic	Contrast Estimate		-.004
	Hypothesized Value		0
	Difference (Estimate- Hypothesized)		-.004
	Standard Error		.037
	Significance		.920
	95% Confidence Interval	Lower Bound	-.076
	for Difference	Upper Bound	.069
Cubic	Contrast Estimate		.093
	Hypothesized Value		0
	Difference (Estimate- Hypothesized)		.093
	Standard Error		.036
	Significance		.009
	95% Confidence Interval	Lower Bound	.023
	for Difference	Upper Bound	.163

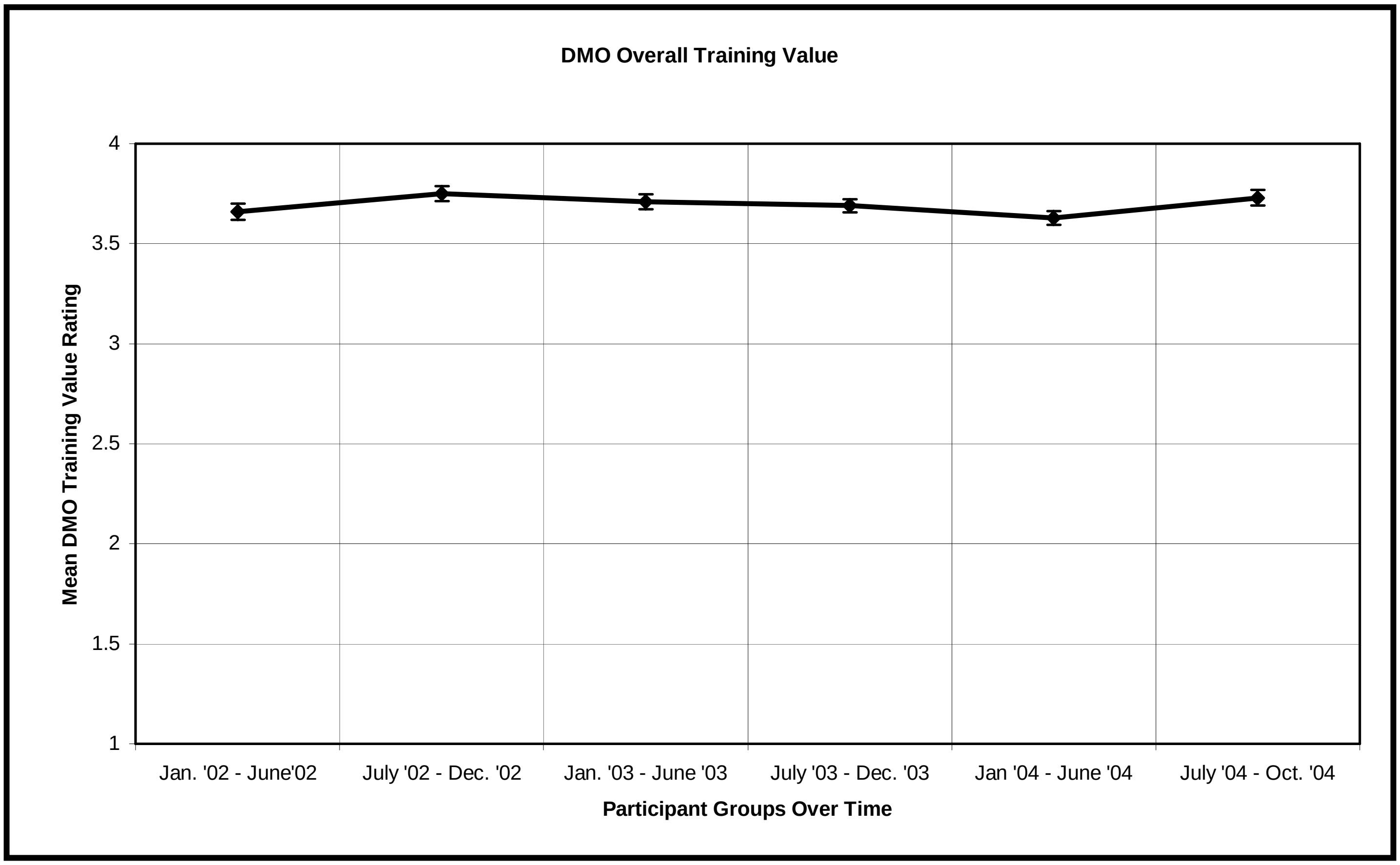

Figure 6. Overall Effect of Time on DMO Overall Training Value

Table 14 Overall Effect of Time on Syllabus/Mission Flow

Source	Type III Sum of Squares	Degrees of Freedom	Mean Square	F	Sig.
Corrected Model	.497[a]	5	.099	1.370	.235
Intercept	3666.391	1	3666.391	50499.969	.000
Participant Groups Over Time	.497	5	.099	1.370	.235
Error	23.233	320	.073		
Total	3774.291	326			
Corrected Total	23.730	325			

a: R Squared = .021 (Adjusted R Squared = .006)

Table 15 Syllabus/Mission Flow Contrast Results

Participant Group Polynomial Contrast			**DMO Expectations**
Linear	Contrast Estimate		.001
	Hypothesized Value		0
	Difference (Estimate- Hypothesized)		.001
	Standard Error		.039
	Significance		.980
	95% Confidence Interval for Difference	Lower Bound	-.076
		Upper Bound	.078
Quadratic	Contrast Estimate		-.057
	Hypothesized Value		0
	Difference (Estimate- Hypothesized)		-.057
	Standard Error		.038
	Significance		.138
	95% Confidence Interval for Difference	Lower Bound	-.132
		Upper Bound	.018
Cubic	Contrast Estimate		.073
	Hypothesized Value		0
	Difference (Estimate- Hypothesized)		.073
	Standard Error		.037
	Significance		.049
	95% Confidence Interval for Difference	Lower Bound	.000
		Upper Bound	.145

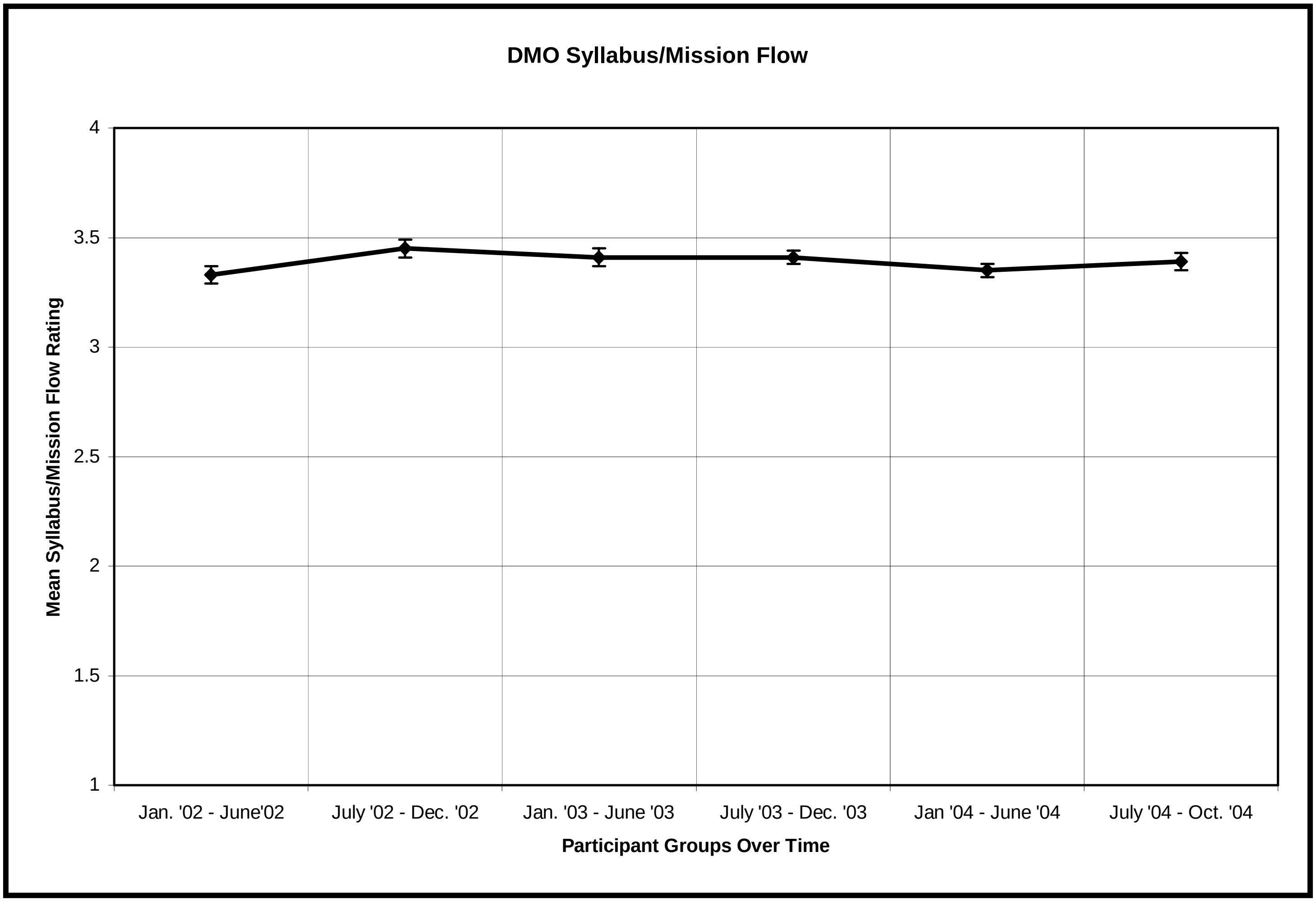

Figure 7. Overall Effect of Time on Syllabus/Mission Flow

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APPENDIX D:
MEC Experience by Environment Results

To what extent can operations… …under these / be experienced	Environments							
	RAP Flying Events		MTC/ FMT	ONW/ OSW	UTD	AFRL/ Mesa	WTT/ DTT	Sustained Combat Ops (e.g., OAF, Desert Storm)
	All except Flag/ CFTR	Flag/ CFTR						
1. Restricted weapons load (e.g., due to previous weapons employment, incompleted reload, or WRM limitations)	2.56	2.47	2.34	.94	2.63	3.63	1.31	1.87
2. Limited fuel remaining (e.g., due to increased fuel consumption, low fuel remaining, lack of tanker support, or the inability to inflight refuel)	2.09	2.31	2.19	1.41	2.44	3.34	1.16	2.12
3. Operating area restrictions (e.g., geographic, altitude, or political)	2.53	2.69	1.75	1.75	1.72	2.75	.94	2.47
4. Restrictions to visibility (e.g., haze)	2.19	2.00	1.78	1.31	2.25	2.63	1.16	1.94
5. Visual illusions	2.09	1.84	1.56	1.12	1.81	2.31	.97	1.88
6. Marginal/minimal cloud clearance	2.38	1.91	1.75	1.19	2.19	2.53	1.03	1.75
7. Daytime employment	3.00	2.81	2.00	1.72	2.50	3.22	1.50	3.28
8. Dusk employment	2.19	2.19	1.63	1.22	2.09	2.63	1.06	2.12
9. Night employment	2.84	2.69	1.66	1.47	2.03	2.19	1.09	2.22
10. Mountainous terrain	2.19	2.72	1.56	.78	1.87	2.47	.75	1.59
11. G-induced physical limitations	2.91	2.50	.25	.69	.75	.84	.25	1.53
12. Degraded comm. (e.g., due to ownship systems malfunction, another aircraft's malfunction, or the inability to use HQ or secure voice by one or more aircraft)	2.38	2.69	1.06	1.28	1.59	1.84	.78	2.00
13. Degraded nav.	1.84	1.81	1.53	.87	2.31	2.00	.84	1.28
14. Degraded weapons employment capability (e.g., fire control, RWR, missiles)	1.78	1.88	1.75	1.09	2.50	2.69	1.09	1.44
15. Battle damage (e.g., operations with battle damage of ownship or of another aircraft in the formation)	1.09	1.03	1.41	.78	1.81	2.03	.88	1.63

To what extent can operations… …under these / be experienced	Environments							
	RAP Flying Events		MTC/ FMT	ONW/ OSW	UTD	AFRL/ Mesa	WTT/ DTT	Sustained Combat Ops (e.g., OAF, Desert Storm)
	All except Flag/ CFTR	Flag/ CFTR						
16. Supersonic employment	1.66	2.28	2.31	1.31	2.69	3.06	1.47	1.84
17. A full range of adversary air threat and mix (e.g., various limitations in maneuvering, tactics, and weapons)	1.47	2.66	1.84	.78	2.25	3.41	1.06	1.44
18. A full range of adversary ground type and mix (including old and latest threats)	1.66	2.72	1.78	1.13	2.19	2.72	1.03	1.72
19. Operations with friendly IADS	1.03	2.22	1.38	1.31	1.69	3.16	.84	1.94
20. Ownship and friendly electronic counter measures	2.06	2.66	1.56	1.25	1.97	2.56	.94	1.91
21. Operations against a threat using chaff/flare	2.56	2.88	1.50	1.78	1.91	2.78	1.03	1.75
22. Using chaff/flare to deny/defeat enemy radar/weapons.	2.47	2.75	1.81	1.31	2.47	3.06	1.09	1.94
23. Operations against adversary comm jam/spoofing	1.00	2.19	.94	.72	1.53	1.59	.50	1.41
24. Operations against air or ground adversary jamming	1.06	2.37	.97	.66	1.19	1.78	.62	1.59
25. ROE limitations (e.g., operations in an environment that has restrictive ID requirements (other than BVR weapons free) such as VID, PID, hostile declaration required by offboard sources)	2.34	2.66	1.62	1.59	1.81	2.78	.97	2.28
26. Fatigue/time on task (e.g., long range force employment)	1.47	1.84	.69	1.34	1.00	1.47	.91	2.37
27. Task saturation	2.34	2.78	1.69	1.09	1.78	3.19	.84	2.12
28. Limited time to act/react to situation	2.41	2.66	1.72	1.16	2.09	3.16	1.16	2.09
29. Radar search responsibilities	2.91	3.03	1.94	1.34	2.34	3.44	1.16	1.94
30. Targeting and sorting responsibilities	2.84	3.00	1.69	1.34	2.22	3.19	1.03	1.87
31. Air refueling	2.44	2.47	.41	1.56	.63	.84	.66	2.47
32. Live weapons employment (e.g., WSEP, combat)	1.47	1.91	.88	1.19	.81	1.69	.53	2.28

To what extent can operations…	Environments							
…under these / be experienced	RAP Flying Events		MTC/ FMT	ONW/ OSW	UTD	AFRL/ Mesa	WTT/ DTT	Sustained Combat Ops (e.g., OAF, Desert Storm)
	All except Flag/ CFTR	Flag/ CFTR						
33. Simulated weapons employment (e.g., training)	2.84	2.50	2.06	.72	2.25	3.03	1.22	1.06
34. Various initial conditions (e.g., perch setups, CAP & tap, and flights on ranges)	2.53	1.88	1.62	.53	2.03	2.62	.84	.88
35. Emergency procedures	1.47	1.34	1.66	.75	2.94	2.00	.75	1.16
36. Formation responsibilities (e.g., position, visual lookout)	3.12	2.91	1.34	1.69	1.00	2.88	.97	2.34
37. Lost mutual support	2.69	2.66	1.44	.88	1.16	2.91	.91	1.75
38. Dynamic retasking/scramble operat2.56ions	1.78	1.97	1.31	1.22	1.56	2.16	1.06	2.12
39. Various employment altitudes (e.g., low, med, high)	2.69	2.63	1.75	.94	2.19	3.16	.94	1.47
40. 1:1 Force ratio (e.g., 2 v 2, 4 v 4)	2.59	2.31	1.84	.59	1.72	3.56	.88	.94
41. 1:2 Force ratio (e.g., 4 v 8)	1.22	2.63	1.69	.47	1.47	3.63	.66	.66
42. 1:3+ Force ratio (e.g., 4 v 12+)	.66	1.97	1.66	.44	1.38	3.66	.59	.63
43. OCA escort missions	1.72	2.16	1.53	.78	1.41	3.16	.72	1.03
44. OCA sweep missions	1.75	2.25	1.50	.63	1.41	3.22	.69	1.13
45. Employment with various package requirements (e.g., operations in conjunction with different aircraft and supporting assets, includes determining and operating with minimum package requirements)	1.69	2.91	1.09	1.13	1.06	2.47	.81	2.28
OVERALL MEANS, STANDARD ERROR	2.09, .17	2.37, .20	1.54, .23	1.08, .18	1.85, .18	2.65, .15	.93, .19	1.74, .23

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